JULY 1952

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

PMM

DESIGN • MANUFACTURE • FINISHING • USE

more than ever before be sure you know

VELVAGLAZE

FOR: { *Aluminum Permanent Mold Castings*
Aluminum Die Castings

THESE 2 NEW FOLDERS GIVE YOU THE VELVAGLAZE STORY

They are interesting, informative, non-technical—

- Tell how VELVAGLAZE processed aluminum die castings reduced a prominent manufacturer's finishing costs by 50%.
- Tell how the VELVAGLAZE process makes aluminum permanent mold castings brighter, smoother, more durable.
- Help progressive design and marketing executives solve today's complex problems.

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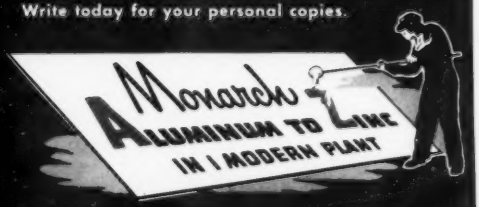

MONARCH ALUMINUM MFG. COMPANY • DEFIANCE, OHIO • WAPAKONETA, OHIO

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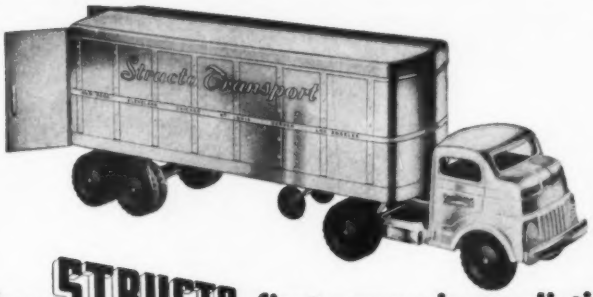
KUX

FIRST NAME IN DIE CASTING MACHINES

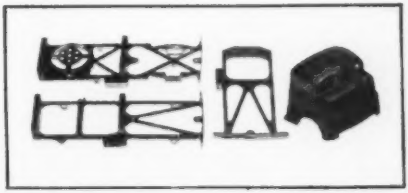


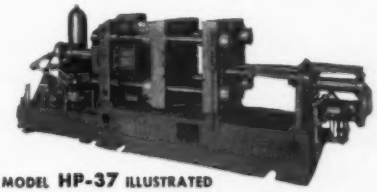
used by STRUCTO first name in realistic toys

UNGENTLE YOUNG HANDS put famous Structo trucks, trailers and steam-shovels through their "live-action" paces again and again. Toys have to be tough to take that. Structo *is* tough. Employing KUX die casting machines, Structo gets lightweight, structural castings of extra-ruggedness . . . to build toys that last a child-time of pleasure!

Is YOUR PRODUCT conditioned for the treatment it has to take? Quality die castings often make a tremendous difference in costs and saleability. KUX, first name in die casting machines, can make that difference for You!

Write for illustrated catalog showing complete line of KUX Die Casting Machines.





MODEL **HP-37** ILLUSTRATED

Hydraulically operated die casting machine for production of aluminum castings.

KUX MACHINE COMPANY • 6725 N. RIDGE • CHICAGO 26, ILLINOIS

KUX

FIRST NAME IN DIE CASTING MACHINES
SELECTED BY FIRST NAMES IN INDUSTRY

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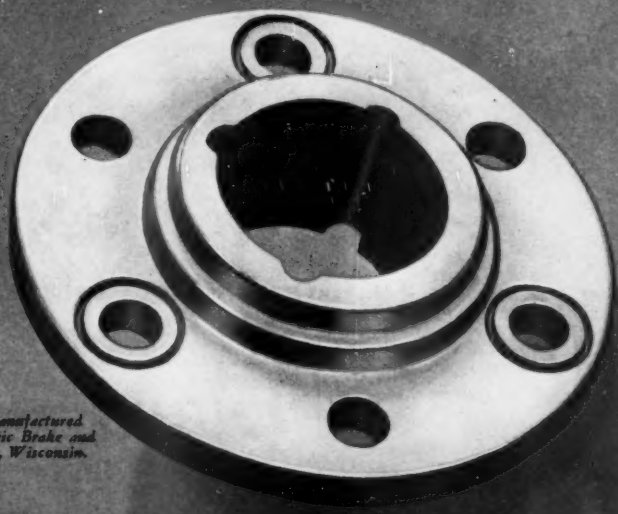
DESIGNING to advantage



Part illustrated manufactured for Warner Electric Brake and Clutch Co., Beloit, Wisconsin.

with MADISON-KIPP

ZINC AND ALUMINUM DIE CASTINGS

The die cast half holes, full holes, spring recesses and center hole taper make this plain looking part a good example of the advantages of the die casting process. Several difficult machining operations are completely eliminated.

It may pay you to review your own designs for die casting possibilities that will bring you continuing manufacturing and marketing advantages.

Please send your inquiries to our home office in Madison, Wisconsin.

madison kipp corporation

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

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JULY 1952
Vol. 10 No. 7

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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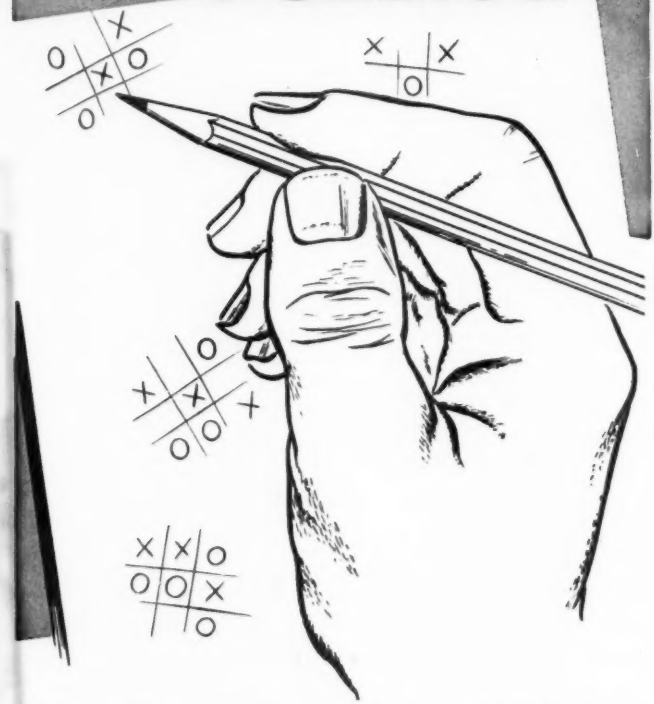
Are You Puzzled?



Yes, die castings are different. It takes more than machines to produce die castings.

Die Castings are Newton-New Haven's business. Here is an organization that has production and engineering talent to help you with your die casting problems.

Newton-New Haven has prepared a booklet on "Dimensioning Die Castings." This is basic data that every Engineer and Designer should have. Write on your company letterhead for your copy.

NEWTON NEW HAVEN

THE NEWTON-NEW HAVEN COMPANY

689 THIRD AVENUE • WEST HAVEN 16 • CONNECTICUT

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LETTERS TO THE EDITOR

PLASTER MOLD CASTINGS

We appreciate and look forward to receiving each month your publication of "Precision Metal Molding."

A section of each issue is devoted to plaster mold casting. We are quite interested in this process and would appreciate your advising what companies are considered leaders in this field.—A.E.W.

Information forwarded.—Ed.

PAINT THAT HANGS ONTO DIE CAST ZINC

We wonder if you can put us in touch with a concern who can help us with the following problem.

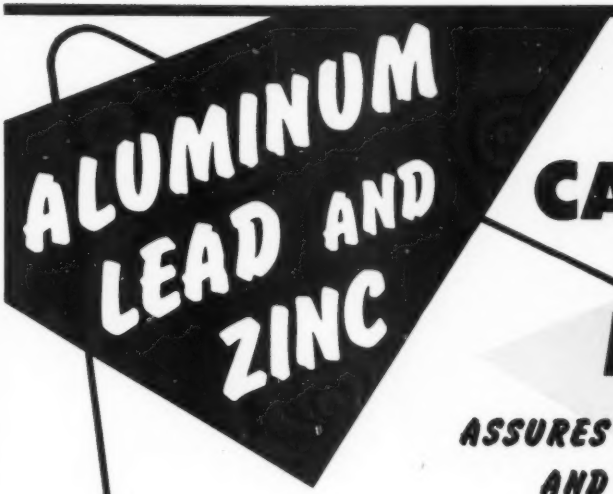
We use what we term a Razor Blade Holder which is die cast of No. 3 Zamak alloy metal. We have been spraying these with various types of aluminum paint including Krylon and other types.

We do not seem to be successful in getting results which do not flake off, and in a short time the holders look as if they had never been painted at all. While we are interested in getting a good job, yet we cannot say that we are unlimited as to price. On the other hand, if you know of any system of finishing for these castings which would be really lasting, in line with the fact that they receive considerable handling, we would appreciate your informing us.—H.E.S.

Die cast zinc alloy has a surface which is sometimes considered difficult to paint, but there are several processes by which a satisfactory paint adhesian can be obtained.

Such diverse products as business machines, household appliances and parking meters are using cast zinc which is given a durable organic finish on a low cost, production basis. The story of one such operation appears on page 46 of this issue.

continued on page 6



DIE CASTING BY FORT

ASSURES ACCURACY, QUALITY AND FAST DELIVERY

FORT has a complete engineering and designing department at your disposal with complete tool and die building facilities on the premises.

FORT has a large die casting department with new ***FORT***-built die casting machines being added regularly.

FORT has designed and built a new machine for casting automobile grilles and other items of comparable size—actual die space is 40″ x 60″ x 36″ thick.

FORT has the enlarged facilities of its Detroit plant combined with the new Marysville, Michigan plant to greatly increase the production of ***FORT*** quality die castings to meet the most exacting delivery requirements.

TRADE FORT MARK

"Certified Analysis Alloys"

FORT DIE CASTING CORPORATION

MARYSVILLE, MICHIGAN

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FOR Westinghouse!

Westinghouse Electric Corp. recently required a part for use on oil circuit breakers. Their rough blueprint called for a link composed of three separate units which had not only to be machined, but welded together.

Atlantic's engineers suggested a design that resulted in a part cast in ONE PIECE from Atlantalloy #31 High Tensile Manganese Bronze . . . a dependable engineering material that is stronger than many steels. This one piece casting eliminated the involved machining, welding and finishing steps—and consequently afforded a substantial saving over former costs.

Write for a copy of "Quality Precision Castings for Industry" today. This booklet shows how the plaster mold process cuts production costs and includes specifications on Atlantic's alloys.

ATLANTIC CASTING and ENGINEERING CORP.
Established 1937
721 Bloomfield Avenue • Clifton, N. J. • PRescott 9-2450

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LETTERS TO THE EDITOR
continued from page 4

There are two specific types of finishes designed to solve your problem. At least two companies manufacture organic coatings specifically suited for attaching to die cast surfaces; and there are several types of inexpensive chromate and phosphate dip treatments which inhibit corrosion and promote good paint adhesion. A list of these has been submitted. These chemical dip (or spray) processes can be applied with simple equipment and give a microcrystalline conversion coating on the surface of the metal which is inert chemically, and yet has a tooth to give a mechanical bond for the paint. —Ed.

DIE CAST PULLEYS

The thought occurred to us that perhaps you can help us because we have been seeking a manufacturer who is regularly engaged in producing "Die Cast Pulleys".

If you know of such a manufacturer we would appreciate very much your cooperation in furnishing us with their name and address. We are aware of manufacturers located in Chicago and therefore these names would not be helpful.—D.R.S.

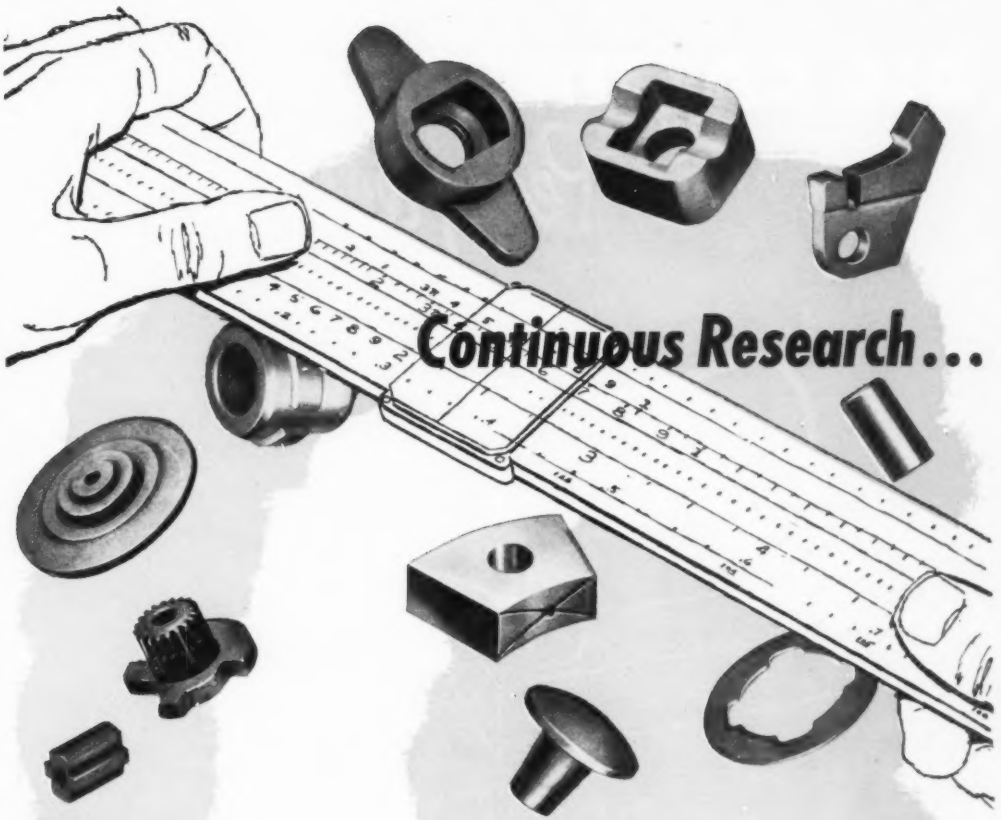
Information forwarded.—Ed.

INTAGLIO LETTERING ARTICLE

The article, "How Intaglio Lettering and Design are Die Cast Without Retracting Slides or Loose Cores" appearing on page 28 of the June 1952 Issue of "Precision Metal Molding" interested me very much.

I would like to obtain about a dozen tear sheets of this article if at all possible. Would you be kind enough to mail them to my attention at the above address and if there are any charges involved. please advise and I will forward a remittance by return mail.—B.F.

Copies forwarded.—Ed.



Continuous Research...

Continuously Wider Benefits!

An important part of Moraine's operations is a continuous program of engineering research and production improvements.

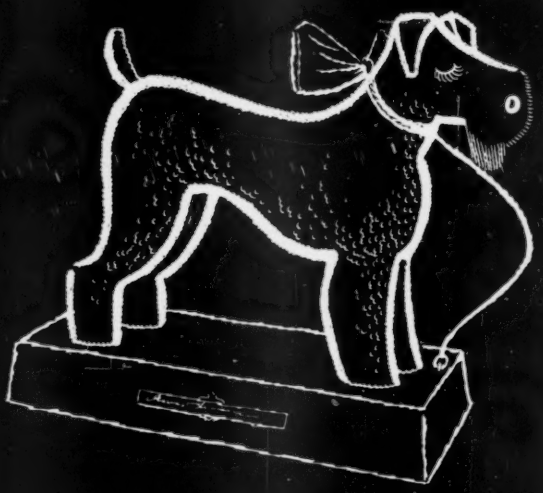
This program, supported by Moraine's experience and knowledge, each year broadens the range of application of Moraine metal powder parts by making it practical to work to closer tolerances and to produce more complicated designs.

Moraine has demonstrated to many industries its ability to produce metal powder parts for them . . . faster and at lowered costs.

Metal Powder Parts by Moraine

MORAINE PRODUCTS DIVISION OF GENERAL MOTORS DAYTON, OHIO

DIE CASTINGS *have Pedigrees too...!*



The consistent uniformity of die castings by PRESSURE is not accidental. Like the strain of a purebred animal, such quality is constantly maintained by the meticulous care in the control of metallurgically correct alloys.

This, plus the utmost attention to the minutest detail, results in the faithful production of die castings of "pedigreed" quality—at PRESSURE.

Send us your inquiries. Write for descriptive circular.

PRESSURE CASTINGS, INC.

die castings

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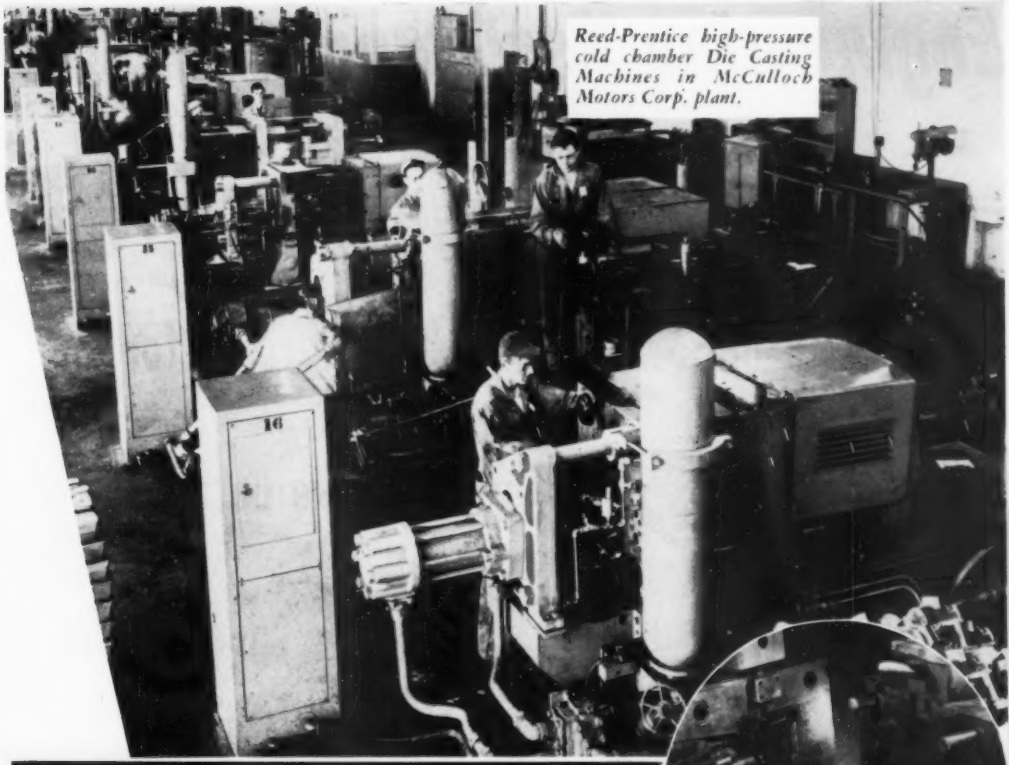


Reed-Prentice high-pressure cold chamber Die Casting Machines in McCulloch Motors Corp. plant.

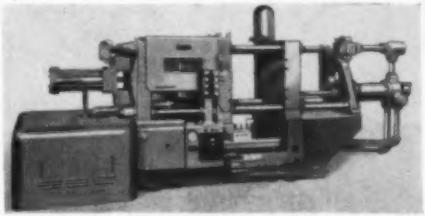
Reed-Prentice Machines are Backbone of Big Magnesium Die Casting Operation

At McCulloch Motors Corp. in Los Angeles, Calif., 12 Reed-Prentice cold chamber Die Casting machines form the backbone of one of the world's largest magnesium die casting departments.

Operating round-the-clock to meet production schedules, the reliable and rugged Reed-Prentice Die Casters produce a variety of die castings for McCulloch Motors' lightweight engines and portable pumps.

If you want to produce higher quality aluminum and magnesium die castings, look to Reed-Prentice Models 1½G and 2G cold chamber machines that provide plunger speed up to 10,000 inches per minute through a new "prefill" arrangement. Write today for full particulars.

Complex die and magnesium cylinder cast from it on Reed-Prentice machine at McCulloch Motors.



Reed-Prentice No. 2G Die Caster with special "prefill" arrangement.

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Syracuse ..... J. F. Owens Machinery Co.
Houston ..... Preston Machine Tool Sales Co.
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Minneapolis ..... Chas. W. Stone Co.
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DIE CASTING
REED-PRENTICE CORP.
WORCESTER MACHINES MASS U.S.A.

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BRANCH OFFICES
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1213 West 3rd St., Cleveland 13, Ohio
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2842 W. Grand Blvd., Detroit 2, Mich.

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Engineering Assistance and technical

advice on any aluminum casting

or extrusion problem is yours for the

asking to help you make better use of

Kaiser Aluminum pig, specification

ingot or extrusion billets

▶ Aluminum pig, specification ingot, extrusion billets. Sales offices in principal cities. Kaiser Aluminum & Chemical Sales, Inc., Oakland, California.

Kaiser Aluminum

A major producer of aluminum pig, specification ingot and extrusion billets

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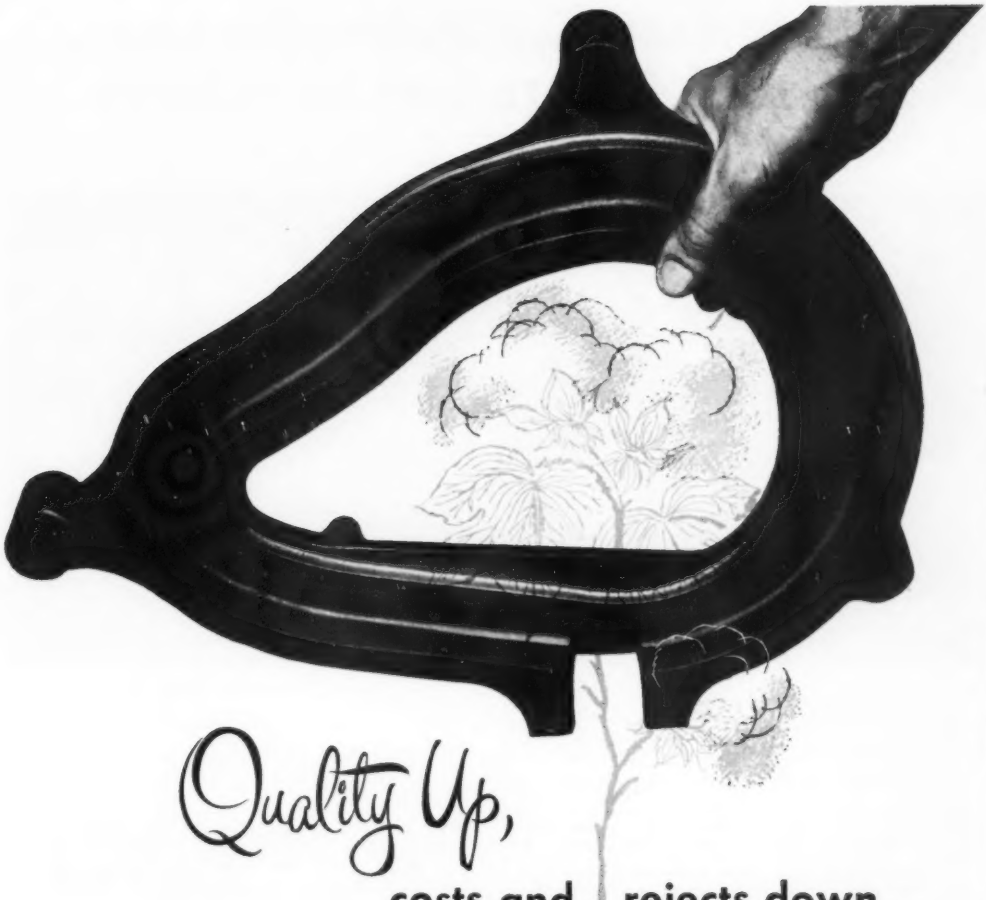

Quality Up,

costs and rejects down
WITH CRUCIBLE TOOL STEEL CASTINGS

The steel part shown above used to be a production headache. A cam for a cotton picking machine, it was originally flame cut from SAE 8730 boiler plate, machined and heat treated. Other difficult steps included end-milling and finish-grinding the cam track. Rejections were high, because the cam often warped during heat treatment.

The problem was solved by casting the cam in Airkool®, a Crucible air-hardening tool steel. When the customer receives the casting from Crucible, all he has to do is finish it, mill the cam track and heat treat. He doesn't have to finish grind — Airkool is non-deforming when properly hardened and tempered. Machining costs are way down and quality is up, since Airkool resists wear far better than the low alloy steel from which the part used to be made.

Crucible's casting facilities often make it possible to use wear- and abrasion-resisting tool steel for complicated machine parts. We may be able to help you just as we helped the cotton picking machine manufacturer. Get in touch with Crucible today!

CRUCIBLE

52 years of Fine steelmaking

first name in special purpose steels

SAND CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

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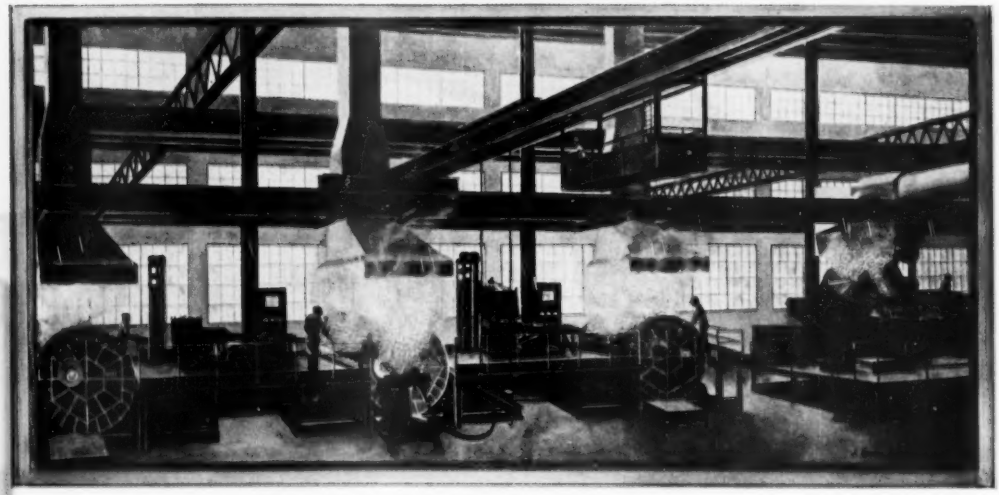
AJAX Induction Melting Furnaces— A Modern Tool for Industry



This oil painting, 9 feet long in full color, by J. Gordon White, shows AJAX-SCOMET installation at Scovill Manufacturing Company, Waterbury, Connecticut.

HERE IS A new tool for melting metal . . . Something that can concentrate enormous power in a small space . . . Something that can be adapted to accurate pouring, to precise temperature control, to inert gas protection, to high-grade refractories . . . A tool that can be used for all existing non-ferrous metals and alloys.

AJAX furnaces paved the way for continuous casting processes which lay dormant in old patents of farsighted inventors who thought ahead of their times. Junghans, with the help of the AJAX furnace, developed his continuous casting process at the Wieland Works in Germany before the last World War.

Scovill perfected the Junghans process in this country and is using AJAX-SCOMET furnaces of unprecedented size for melting, as shown in painting above. Nichols Wire & Aluminum Company used the first commercial Properzi machine for continuous production of aluminum wire from molten metal delivered by AJAX furnaces; U. S. Metals Refining Company is using AJAX-SCOMET furnaces for continuous casting of oxygen-free copper. Cleveland Graphite Bronze Company produce their famous stock for steel backed copper-lead bearings exclusively in AJAX melting furnaces. Hunter Douglas Corporation, Riverside, California, uses AJAX furnaces for continuous casting of aluminum alloy strips for venetian blinds. AJAX furnaces are used in many plants and research laboratories for continuous bonding aluminum to steel.

AJAX made the first furnace for galvanizing steel in a refractory lining with accurate temperature control. AJAX furnaces were instrumental in the realization of modern squirrel-cage aluminum rotor production. AJAX supplied the first commercial automatic pouring device for die-casting machines.

These few examples show how AJAX induction furnaces can be applied to modern manufacturing methods. Write us for further information.

AJAX **AJAX ENGINEERING CORP., TRENTON 7, N. J.**

TAMA-WYATT

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

For additional information Circle No. 1 on the Reader Service Card

Selection Factor in Choosing Alloys for Die Castings

		Aluminum Alloys ASTM Nos. S5, SC2	Brass	Magnesium Alloys ASTM Nos. 12 and 13	Zinc Alloys ASTM Nos. 21, 23, 25
Mechanical Properties	Tensile strength	3	1 (Strongest)	3	2
	Impact strength	3	1 (Toughest)	3	2
	Elongation	4	1 (Most ductile)	3	2
	Dimensional stability	2	1 (Most stable)	3	3[a]
	Resistance to cold flow	2	1 (Most resistant)	2	3
	Brinell hardness	3	1 (Hardest)	3	2
Physical Constants	Electrical conductivity	1 (Highest)	2	3	2
	Thermal conductivity	1 (Highest)	2	4	3
	Melting point	2	1 (Highest)	2	3
	Weight, per Cu in.	2	4	1 (Lightest)	3
Casting Characteristics	Ease, speed of casting	2	3	2	1 (Easiest)
	Maximum feasible size	1 (Largest feasible)	2	1 (Largest feasible)	1 (Largest feasible)
	Complexity of shape	1 (Greatest possible)	2	1 (Greatest possible)	1 (Greatest possible)
	Dimensional accuracy	2	3	2	1 (Most accurate)
	Minimum section thickness	2	3	2	1 (Thinnest)
	Surface smoothness	2	3	2	1 (Smoothest)
Cost	Die cost[b]	2	3	2	1 (Lowest)
	Production cost	2	3	2	1 (Lowest)
	Machining cost	2	3	1 (Lowest)	1 (Lowest)
	Finishing cost[c]	3	2	3	1 (Lowest)
	Cost per piece[d]	2	3	2	1 (Lowest)
Extent of Use		2	4	3	1 (Most used)

Source: Materials & Methods

a *Through the use of a low temperature annealing treatment, Alloy No. 23 can be made virtually stable in dimensions.*

b *Dies for casting the low melting point alloys are least expensive and have longest life.*

c *Includes polishing and buffing expense as well as ease of applying all types of commercial finishes, both electrodeposited and organic.*

d *Based on die, material and fuel costs, production speed, machining and finishing costs.*

ZINC is the most adaptable metal for the die casting process and provides the best combination of physical and chemical properties. Zinc die castings are stable, strong, and can be cast to close tolerances; they are easily machined and a large variety of beautiful metallic and organic finishes can be readily applied to the castings. Industry's recognition of these factors is indicated by a two-hundred-fold increase in the use of zinc die castings in the last ten years, plus the fact that nearly 70% of *all* die castings by weight are made of zinc.

DIE CASTING is the Process • ZINC, the Metal • BUNKER HILL, the Preferred Zinc

Eastern Sales Agents: **ST. JOSEPH LEAD CO., 250 PARK AVE., NEW YORK 17**

BUNKER HILL 99.99+% ZINC

Sales Office for Pacific Coast: **NORTHWEST LEAD CO., SEATTLE, WASH.**

USCO

USCO K Aluminum Alloy is one of several standard die-casting alloys of the AXS-679 Revision 3 type. USCO K and the other aluminum alloys in the K series are production controlled from raw materials to finished ingot under the most modern methods of alloying and refining—giving you the uniform mechanical and physical properties you desire in your castings. If you prefer, we can produce an aluminum die-casting alloy to your exact specifications.

The specifications on AXS-679 Revision 3 are broad. In USCO K the Si is kept at the maximum limit to insure fluidity. The detrimental elements—Mg, Fe, Ni and Cr—are kept at the low limit to combat die-cast sludge. Even the unspecified elements—Pb and Na—are kept at a trace to prevent soldering.

Our metallurgical engineers, who have a practical working knowledge of your problems, are at your service always.

For outstanding castability—maximum production economy—uniformity of analysis and performance—order USCO K!

FREE—Send for your copy of the USCO Aluminum Alloy Selector. A handy aid to analysis, specifications and many other foundry problems.

For 48 years, pioneers in aluminum development.

USCO U. S. REDUCTION CO.
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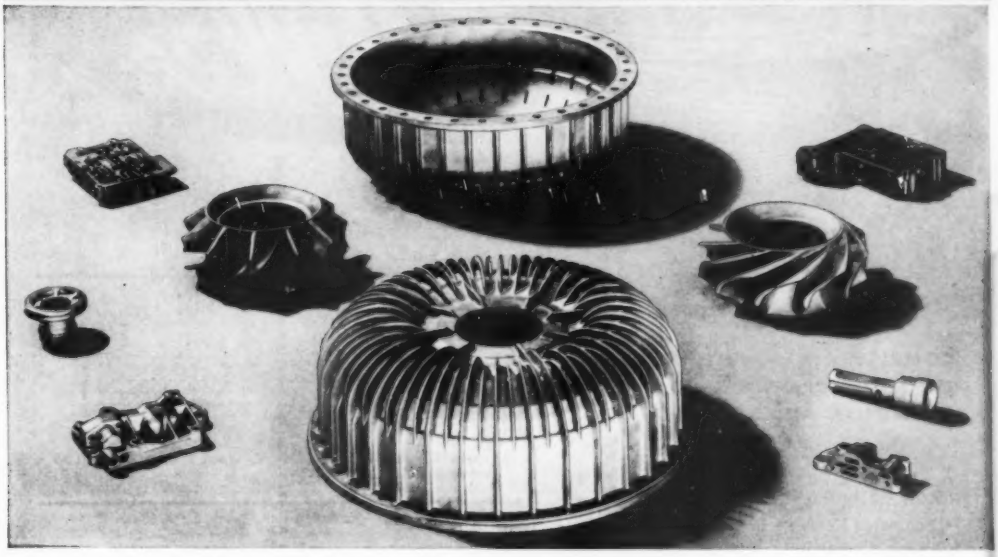

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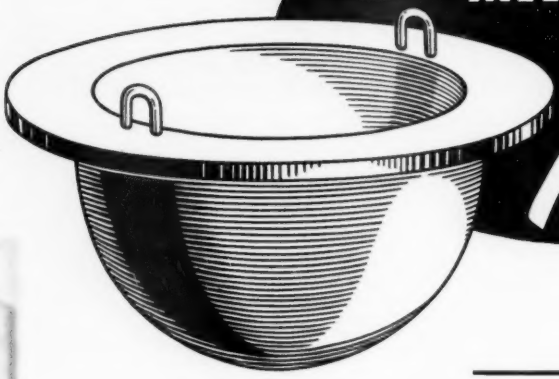

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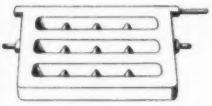

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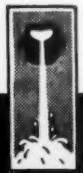

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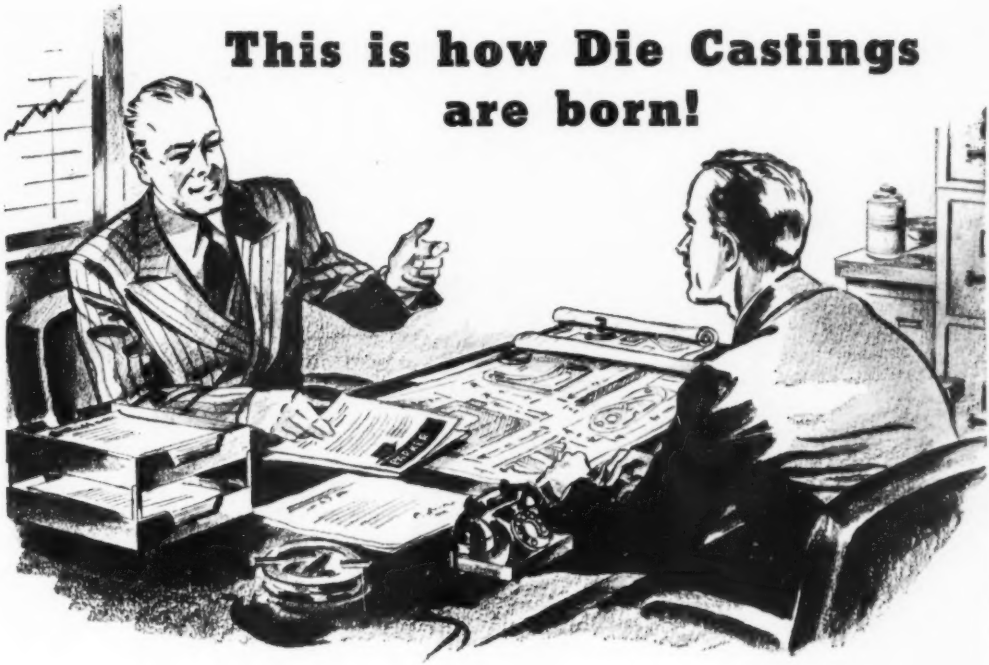

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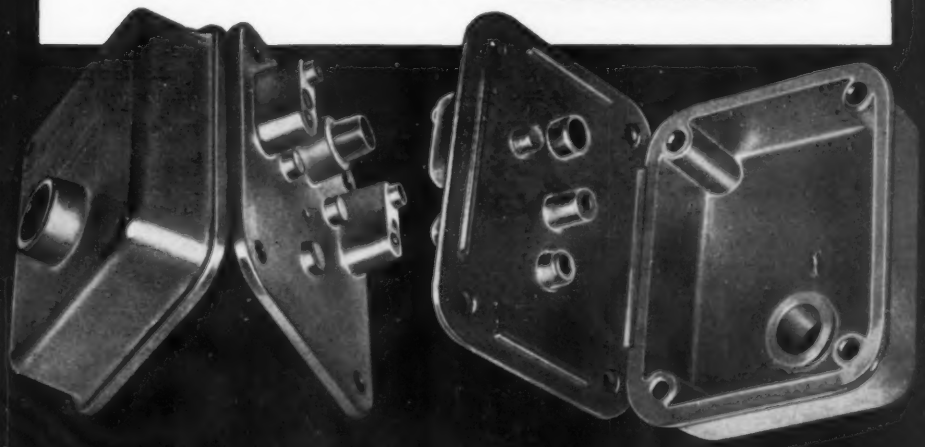
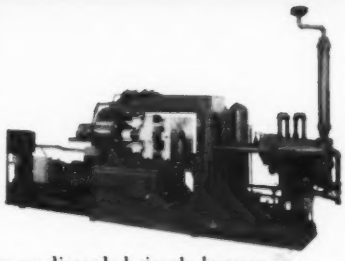
Says Jaen Electromotive Corporation: "The over-all cost of the die castings is only *one-third* that of the machined sand cast aluminum pieces initially used. We shall be able to reduce our list price on this type of unit, and increase sales appreciably."

The next time *you* have to select a manufacturing procedure, remember this example of remarkable savings made possible by die casting — and consult with us. We shall welcome the opportunity to help you increase your output, improve your products, and *hold down your production costs.*



Super Dense Die Casting a wild-goose chase?

Cross section of aluminum die casting (end plate for air brake vacuum cylinder) about 4/5 actual size



not on a LESTER!

Many logical applications for aluminum die castings are discarded simply because some die casters don't have the right machines to do the job. But a whole new field of applications is opened, when you consider the work being done on Lester-Phoenix cold chamber machines equipped with a Pre-fill. Take the experience of Bendix Products Division of Bendix Aviation Corporation, for example. The part shown here is an end plate for an air brake vacuum cylinder—a critical application that demands a super-dense die casting, thoroughly sound and leak-proof.

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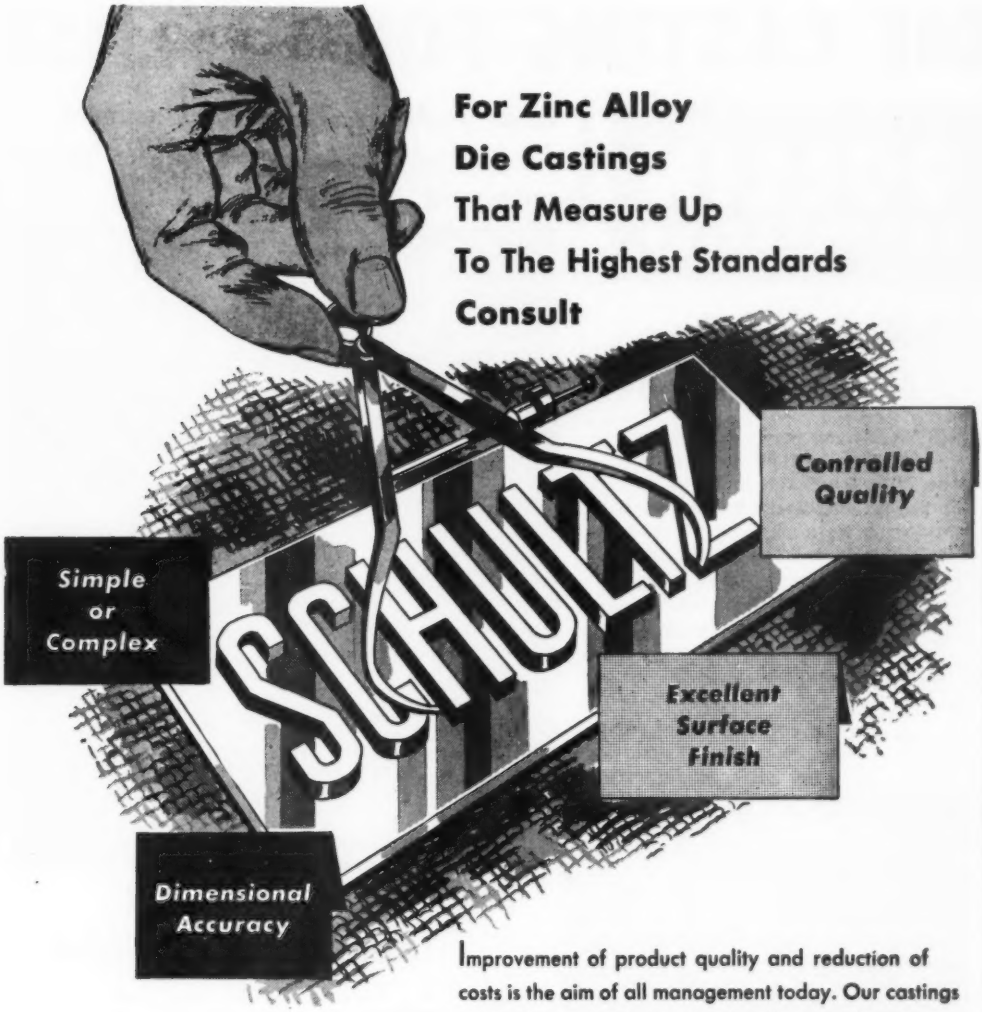

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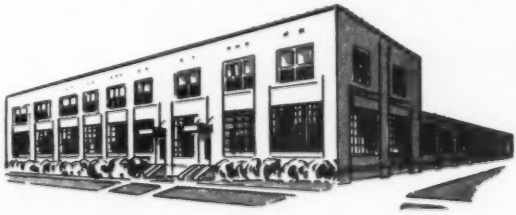

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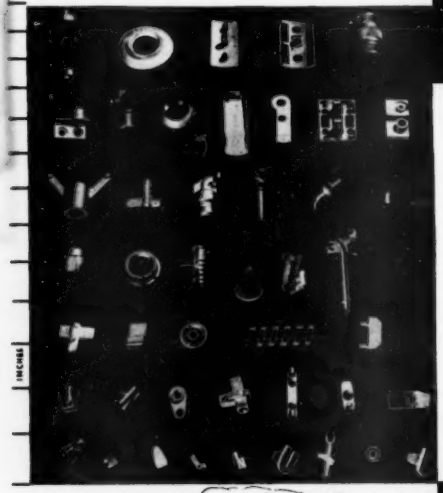

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PART ONE

Technology of prealloyed STAINLESS STEEL POWDERS— properties, production, uses

by

ARTHUR H. GROBE, Research Metallurgist

GEORGE A. ROBERTS, Chief Metallurgist

Vanadium-Alloys Steel Company
Latrobe, Pennsylvania

DURING the past decade, there has been a growing interest in the use of prealloyed powders by the powder metallurgy industry. This stems, naturally, from the metallurgical knowledge that alloys, in general have improved combinations of physical or mechanical properties over pure metals. In the search for prealloyed materials, great initial progress was made in non-ferrous fields with the advent of brass and other copper base mixtures in powder form. In the ferrous field, progress has been much slower and outside of a few attempts to produce iron-carbon alloys the ordinary wrought steels have had no counter part in powder metallurgy technology. Early attention, naturally, centered upon one family of ferrous alloys useful for their corrosion resistant properties; that is, the stainless steels.

For the past ten years only one stainless steel powder has been available to the powder metallurgy industry. This material, limited to a straight 18% chromium, 8% nickel composition, found only nominal usage. During the past two years it has been possible to obtain stainless steel powders of any desired composition. In addition, compared with the previous type powder, it has been possible to lower considerably the sintering temperature and provide for more ready adoption of stainless steel powders throughout industry.

Current interest in the use of stainless steel powders has undoubtedly been raised to a high level because of the research and development work being conducted in a number of plants and laboratories on high temperature applications of prealloyed materials. At the present time, prealloyed stainless steel powders are being employed widely for mechanical parts, industrial filters, industrial paints, and surface coatings.

The total quantity of powder being consumed is still relatively small compared to other types of powder but the number of new applications being put into production each month is steadily growing—a tribute to the versatility of the powder producing process employed and to the practicability of the resultant product. In the Spring of 1951, Government restrictions upon the use of stainless steels containing nickel effectively stopped a large number of consumer items which were in the production planning or in the production stage. Since that time items directly dealing with defense production have been introduced and at the present time consumption equals that achieved prior to the institution of rigid controls.

In an effort to conserve nickel it has been possible to substitute a 16% chromium, 2% nickel, type 431 stainless steel for some

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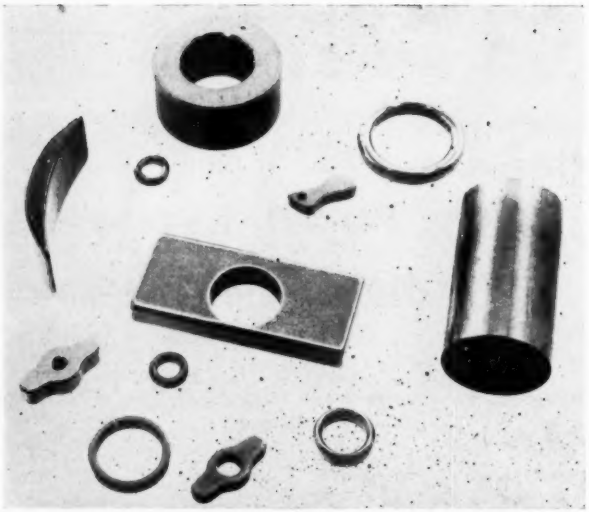
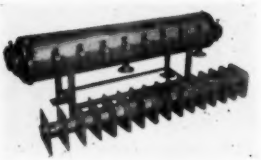
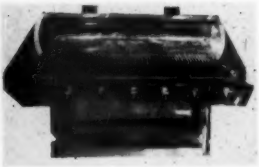


1. RANGE OF SIZES AND SHAPES now being produced from stainless steel powders is illustrated by the group of production parts shown above. These parts are produced in type 302B, 316 and 431 stainless steel powders by Keystone Carbon Co., St. Marys, Pa.





2. FILTER ASSEMBLIES with all filter sections built up from porous stainless steel powder sheets are shown above: (top) 16 sq. ft. of filter with 2 in. cake space; (center) water filter for 3 in. pipe size, filter area 60 sq. ft.; (bottom) part of group of 127 porous stainless steel filters for removing fluid catalyst from hot petroleum gases. Total area 1524 sq. ft. All filter units manufactured by Micro Metallic Corp., Glen Cove, N. Y.

of the 18% chromium, 8% nickel material formerly employed. The use of the 16-2 stainless steel powder is largely confined to industrial parts, some of which are illustrated in Figure 1, along with parts molded from type 302B and 316 powders.

The first major application for mechanical parts has been in small driving arms used in the intermediate gear trains of water meters. These parts, which must operate satisfactorily over a period as long as 40 to 50 years, require a material resistant to wear and corrosion by the various waters throughout the country. Type 316 stainless steel powder, subjected to a passivation treatment after sintering, has been found quite suitable for such service.

In addition, powdered stainless steel parts have currently replaced drawn stainless tubing for sleeve bearings and bushings in industrial meters that are used to measure nitric acid or other highly corrosive liquids. In this particular application one of the most important problems was the seizure of the 18-8 stainless steel shaft when the bushing was made of the same wrought material.

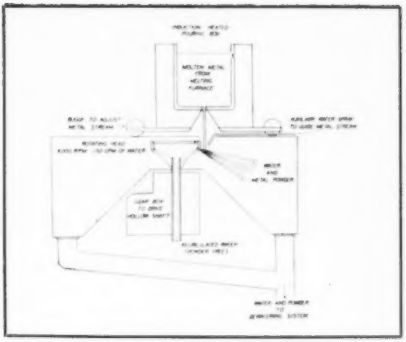
One of the outstanding properties revealed by powdered stainless steel compacts is their resistance to this type of seizure. Normally, with austenitic stainless steel parts made from wrought or cast material, the tendency of mating parts to weld together is extremely high and the hardness or structural differences of these parts cannot be adjusted sufficiently to prevent this failure. Bushings made from prealloyed stainless steel powder resist seizure and have better wearing qualities, probably attributable to the unique

TABLE I

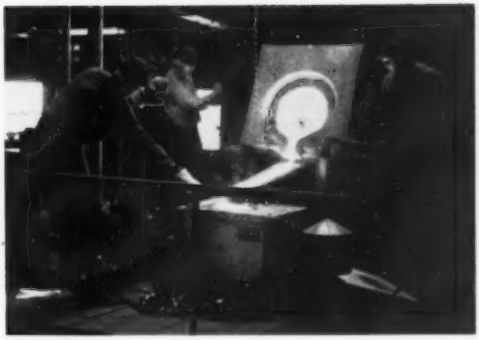
COMPOSITION OF STANDARD VASCO STAINLESS STEEL POWDERS

Per Cent

	302B	316	318	318 Si	431
C	.12 Max.	.12 Max.	.12 Max.	.12 Max.	.12 Max.
Cr	17.00/19.00	17.00/19.00	17.00/19.00	17.00/19.00	15.00/17.00
Ni	7.00/9.00	10.00/12.00	10.00/12.00	10.00/12.00	1.25/2.50
Mo	--	1.75/2.50	1.75/2.50	1.75/2.50	--
Cb	--	--	80/1.20	.80/1.20	--
Si	2.00/3.00	2.00/3.00	.80/1.10	2.00/3.00	2.00/3.00
Mn	1.00 Max.	1.00 Max.	1 00 Max.	1.00 Max.	1.00 Max.



3. POWDER DISINTEGRATING MACHINE is illustrated with the schematic drawing, above. Stainless steel descending in molten stream is disintegrated by water jet.



4. POURING MOLTEN METAL from the 1000-lb. melting furnace into a 150-lb. tundish which empties a 3/16-7/32 in. stream of metal into the disintegrator.

structure and lower density of the powder compacts.

Other successful applications of stainless steel powder parts have included guides for fishing rods, cigarette lighter cams, small gears, levers, and bearings.

The second most important application of stainless steel powder is in the field of industrial filters. This application was the first successful one for prealloyed stainless steel powders and requires a considerable variety of different analyses to satisfy the varying industrial corrosion conditions encountered. Typical filter assemblies built up from porous stainless steel sheets or plates are shown in Figure 2. In general, these filters are produced from types 302 and 316 stainless steel powders. Because some of the fabrication techniques involve welding and the need for prevention of intergranular corrosion in service following the welding, columbium additions or titanium additions have frequently been made to the type 316 when used for this purpose.

Type 302B stainless steel powder is used as a raw material for the production of stainless steel flake. This flake, when mixed with the proper vehicle, has provided an excellent protective paint coating for structures and industrial units subjected to an atmospheric corrosion environment. Finally, stainless steel powder has been employed for spray welding of protective coatings on industrial parts requiring either corrosion or heat resistance.

These diversified applications require considerable variation in the specific properties and qualities of the powders employed. In this article the versatile process for manufacturing such powders will be described. Since the majority of readers will be interested in the application of these powders to mechanical parts, the article will describe, in detail, those standard powders which are suitable for this purpose.

Production methods

The process for making prealloyed stainless steel powder at the Vanadium-Alloys Steel Company, Latrobe, Pennsylvania, parallels that for other prealloyed powders described in part in previous publications (1) (2). Because each alloy presents different problems of production, minor adjustments in processing are required and only after repeated lots of any grade have been produced can it be considered standard. The grades described in this article are those that have found industrial applications based on their corrosion resistance, weldability, moldability, and favorable combination of strength and ductility after pressing and sintering.

These stainless steels are disintegrated by water jets hitting a small stream of the molten alloy in a specially designed production unit, shown schematically in Figure 3. Steel of the desired composition is melted in 1,000-pound electric induction furnaces and transferred to a tundish, lined with zirconium silicate refractory, and heated electrically in order to control and maintain the temperature of the molten metal, Figure 4. The liquid metal flows from the botttom of the tundish

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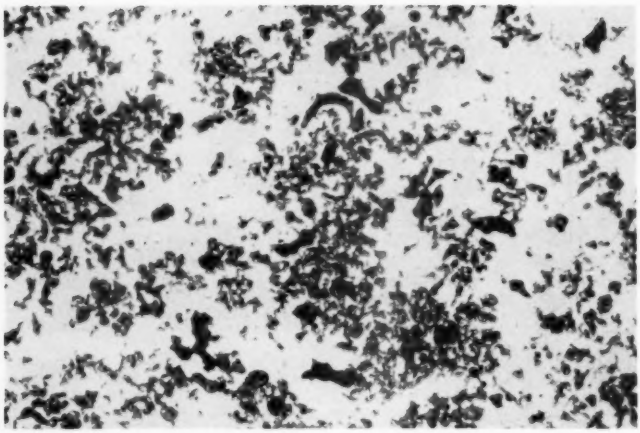

5. PARTICLE SHAPE of 302B stainless steel powder is shown above, 20X. This is typical of moldable powders, apparent densities for which are listed in Table II, below. Also available are spherical type stainless steel powders.

TABLE II

PROPERTIES OF STAINLESS STEEL POWDERS

Average Values From Production Lots of -100 Mesh Powder

Vasco Type	Sieve Analysis Mesh Size	Per Cent	Compression Ratio		Appar. Density gms./c.c.	Flow Time Sec.	Weight Loss in Hydrogen Max. %
			Compacting				
302B	+100	3	Pressure				
	−100+140	21	t.s.i.				
	−140+200	25	30	1.79			
	−200+270	15	40	1.91	2.8	28	0.35
	−270+325	13	50	2.01			
	−325	23					
316	+100	3					
	−100+140	24					
	−140+200	25	30	1.99			
	−200+270	16	40	2.16	2.17	33	0.35
	−270+325	12	50	2.27			
	−325	20					
318	+100	3					
	−100+140	17					
	−140+200	23	30	1.93			
	−200+270	15	40	2.09	2.7	29	0.45
	−270+325	12	50	2.20			
	−325	30					
318 Si	+100	3					
	−100+140	14					
	−140+200	21	30	1.69			
	−200+270	20	40	1.83	2.7	32	0.35
	−270+325	13	50	1.96			
	−325	29					
431	+100	3					
	−100+140	19	30	1.69			
	−140+200	25	40	1.81	2.9	27	0.40
	−200+270	14	50	1.90			
	−270+325	12					
	−325	27					

furnace through a small zirconia nozzle which has a hole diameter of 3/16 to 7/32 of an inch.

In the disintegrator, the pencil-thin stream of molten metal is blasted into powder by the water jets which emerge from a hollow rotating disk through sixteen nozzles placed at the outer periphery. The disk rotates at a speed of 6,000 r.p.m. and is attached to the top of a hollow shaft through which water flows at low pressure. Centrifugal action of the revolving disk builds up sufficient pressure to supply the required disintegrating energy.

The mixture of water and powder is then pumped to a dewatering system, which consists of a Deister classifier, Allen slime cone, and a Vortrap. The majority of the powder is collected in the cone, while the extreme fines are collected in the Vortrap. Undesired coarse particles may be separated in the Deister classifier and discarded. The product of the cone and Vortrap, containing about 10 to 15 percent moisture, is further dewatered in an Oliver rotating filter to about 3 to 5 percent.

The product is then dried and screened to the desired mesh size. By proper control of composition, disintegration conditions, and disintegrating atmosphere it is possible to produce stainless steel powders containing more than 15% chromium and 2% nickel with a minimum of surface oxide so that a time consuming and costly annealing and reducing cycle is unnecessary.

Five standard grades of Vasco stainless steel powder are now available for the production of filters, paints, coatings, and mechanical parts by the powder metallurgy industry. These, listed in Table 1, have proved useful to industry based on satisfactory moldability and final

continued on page 67

MARKED DECREASE IN MACHINING TIME has been secured by incorporating a camming surface, a housing, and cam pins into one die casting. Nearly ready for use as received, this die casting shows a large enough saving in manufacturing cost to permit use of the process even in small quantities.

Internal cam at low cost by DIE CASTING

By S. BROADWIN
Secretary
Ainslie Knitting Machine Co., Inc.

GENERATION of a camming surface whether by machining methods or simply the finishing of a casting or forging is usually an expensive operation. Generally either special machines or special set-ups on standard machines are required. When the number of cams to be cut is large, either special machines or special processes are justified, but when the number of units is relatively small the manufacturer is generally "stuck" with time-consuming machining.

When, however, the camming surface can be incorporated into a sub-assembly in such a manner that several machine operations can be eliminated through the use of one precisely cast component; then the use of a seemingly expensive process for a small number of parts can be amply justified.

A machine component which illustrates this generalization is the cam shell used by the Ainslie Knitting Machine Co. of Brooklyn, N. Y. on their manually operated Auto-Knitter. This cam shell, cast by Advance Pressure Castings, Inc. of Brooklyn, N. Y. is a zinc die casting as shown in the illustration.

This casting is worthy of closer examination since it illustrates nicely several of the features that make possible the use of die casting for short runs because of the relatively large savings in machining time that result.

The camming surface is, of course, the most outstanding feature. Since this surface is on the inside, the machining of it would present considerable trouble whether it were cut from solid stock or simply finished after sand casting or forging. As an integral part of a die casting it is, in this case, cast with sufficiently close tolerances to be used in the as-cast condition.

The stud shown is another advantage conferred by die casting. Instead of having to locate, drill, and tap the hole and then insert the stud; it is simply cast as an insert when the shell is made. Here again, accuracy of the casting operation is adequate for location of the stud.

The holes for the two up-throw cam pins are cored in the casting operation as is the counterbored machine screw hole below the wire loop. Other cored holes in this casting are the two small holes into which the spring band holder is pressed and the two larger ribber arm mounting holes.

Some machining is necessary on this casting in spite of the many operations that have been eliminated by the use of a die casting. The bottom surface must be faced and the bottom flange bore machined to size. These two operations are required since dimensional tolerances on the base are closer than this particular is held to.

While this cam shell was originally designed as a die casting, preliminary engineering estimates indicated that a machined sand casting, the only other economical fabricating method, would cost at least three times as much when the shell was ready for installation in the knitting machine.

Long range planning has paid off

in the design of these perforators. Although only limited quantities of any one model are produced annally, die cast parts have been used for many years. The original tooling costs have long since been amortized, but the economy of die cast zinc components continues to be a major factor in this company's production plans.

Effective use of DIE CASTINGS for limited production runs

WHEN less than 30 percent of the output of a product is in standard models and the balance is in "specials," it becomes a question whether or not die casting tools can be amortized. In such an instance, other factors besides total volume of production must be brought into the picture, including rate of obsolescence, number of interchangeable parts among different models, reduction of secondary operations and the possibility of achieving functional improvements.

An example of this type of production occurs in the field of specialized business machines, where perforating equipment occupies a well-established niche. The number and variety of installations for which these machines are purchased precludes more than limited standardization.

American Perforator Company of Chicago builds this type of equipment for banks, utilities companies and other business firms having cashiering operations. The perforating machines are used to sever stubs from paid bills and to perforate the word, "Paid," the date, company initials and cashier's identification on the customer's receipt.

American Perforator Company manufactures a wide variety of models, ranging from the small hand-operated model to the latest electrically-actuated portable unit designed for fastest operation with the least physical exertion.

Die castings are used in virtually every model of perforator that the company produces. Some of the reasons why they find these components more economical and more satisfactory, even in relatively limited quantities, are explained with each illustration.

Die castings have been used for some of these parts for more than 15 years. In some cases, die costs have long since been amortized and the long range planning which originally

determined the choice of die casting as a production method is now paying off in substantial savings.

Badger Die Casting Company of Milwaukee has been producing these zinc die castings for American Perforator since the first one was introduced into their products. Some of these castings represent particularly tricky examples of die design to core holes or form additional features in the casting which would otherwise require extra machining.

Although these perforating units are portable, zinc alloy has been used rather than aluminum because, paradoxically enough, weight is a desirable feature. If these units were too light, there would be a tendency to creep or shift position during operation, so that the extra weight of the zinc die castings provides stability.

They are called "portable" units because, in contrast to the massive cast iron units which were once the conventional perforating machines, they can be placed in position quite easily without building a substructure or special frame to support them. The old-fashioned perforators were actually "built-in" and required a crew of millwrights to move one of them. Their construction normally included a flywheel, trip rod and treadle, and a

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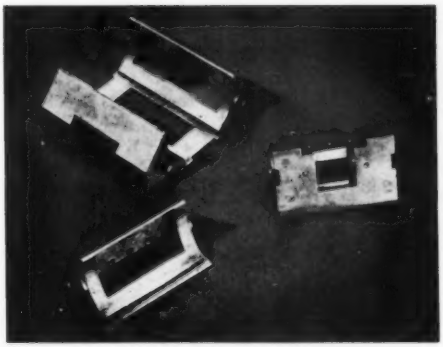
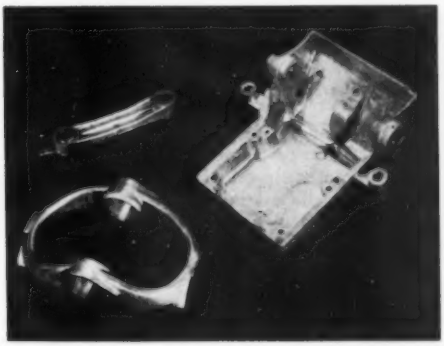
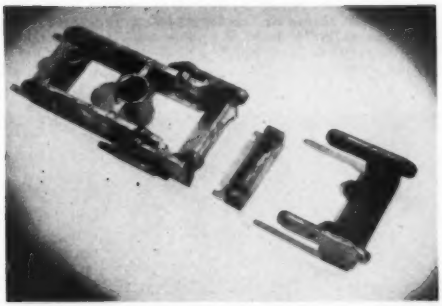


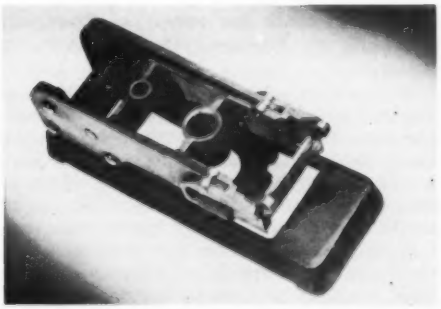
A MEANS OF ASSEMBLING a steel plate onto the bottom of these zinc die castings is provided integrally. Small bosses formed on the underside fit through holes in the steel plate, and are peened over to make a rigid permanent fastening.

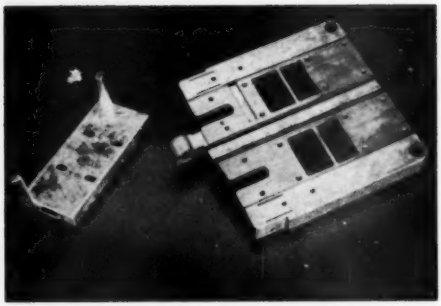


INHERENT ACCURACY and low cost make these three castings in zinc especially suitable for the manufacture of the automatic electric perforator. They are: a small mechanical linkage with pressed-in bearings, a yoke for mounting the motor, and a cover casting.



TO SUPPORT THE COMPLETE MECHANISM of the Junior Perforator between a pair of punched steel side frames, the die cast zinc chassis, above left, provides pivot holes, spring seat, side grooves into which the steel perforation plate slides, and other integral mounting features. It is a means of bringing all of the mounting elements into a single piece which can be suspended from the heavy iron base.





FEATURES WORTH NOTING concerning the two castings shown left are the vertical arms on the smaller casting, and the narrow slots cored into the large base casting. Since the die parting on the small casting lies along the lower edge, the parting has to be extended upward to form the underside of the extended arms. Features like this increase the die construction cost and are difficult to fill properly in casting. The narrow slots on the larger casting are less than 1/16" wide and about an inch in length. All holes of varying size and shape are cored to finish size.

400-lb. weight secured to the floor beneath the cashier's counter. By contrast, therefore, these new motor-driven, plug-in perforators are extremely portable.

Where die castings are used here, they are almost always a means of reducing or eliminating machining. The factory where these perforators are built, resembles a high class machine shop rather than the conveyorized production line usually associated with business machine output. Machining is regarded as the only way to get the close dimensions needed on small production quantities. Thus, wherever a die casting can be used, it represents a means of getting a finished or semi-finished component without elaborate machine tool investment, expensive jigs and fixtures, or valuable floor space.

The physical properties of zinc die castings permit them to be used for many styles of mounting frames and chassis, for yokes and links, for covers and housings, and for small irregularly-shaped fittings. Surface finish as received is excellent, dimensional tolerances are close and piece cost is low. They help American Perforator to produce a superior product in limited quantities at moderate price, and the prospect is that their investment in dies many years ago will continue to pay off for many years to come.

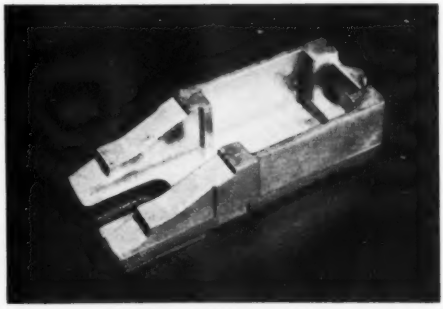
PLASTER MOLD CASTING . . . "less expensive, better looking, easier to assemble as cast"

COMPLEX shape is not necessarily a prerequisite in order for the plaster mold casting process to be economical, as is proved by the punch holder for an automatic perforating machine, shown *right*. This component is manufactured for American Perforator Company by Universal Castings Corp. of Chicago.

It is cast in yellow brass and has the high physical strength, smooth surfaces and accurate dimensions required. Although it might easily be sand cast, its surface quality, accuracy and density would be of a lower order, so that any differential in initial piece price would be lost in secondary operations.

As pointed out above, this thick-sectioned casting is not an especially difficult one to produce, requires no cross-coring or other elements which might make tooling costs rise, and is not a highly critical component. It is, nevertheless, less expensive, better looking and easier to assemble as cast, than would be possible by any alternative casting method.

GYPSUM PLASTER MOLDS yield a casting which has a smooth, dense surface and tolerances can normally be held to ±.005 on a part such as this punch holder. This piece is cast in yellow brass.



TO SECURE MAXIMUM LIFE from dies and punches used to mold metal powders, tungsten carbide dies like the one shown right are being widely used. In addition to longer life, better dimensional accuracy and stability can be secured with a superior surface finish.

Carbide dies effectively used in POWDER METALLURGY

By KENNETH M. GLESZER*

THE USE of cemented tungsten carbide dies, core rods, and faced punches for forming powdered metal compacts has been rapidly increasing. With this increase in use, a number of problems have arisen which puzzle and consternate the inexperienced manufacturer and user of these tools. This article is aimed at suggesting the true cause and possible cure of most of these problems.

When the grade of carbide is properly selected and good finishing technique is employed by the die manufacturer a life expectancy of one to twenty million pieces is possible providing the user of the tool gives consideration to proper lubrication of the powder mixture and to alignment in the press.

There are several other advantages to the use of tungsten carbide for compacting tools other than the pure economics of life expectancy.

- Closer tolerance and more uniform parts can be produced. This is due to the extremely high modulus of elasticity of the material.
- Dies do not distort as much from optimum size under high pressure.
- Very fine surface finish in the order of 2 to 5 micro-inches can be achieved on the parts produced from carbide tools.
- Briquette ejection pressures are lower making possible molding of parts which normally would not eject properly in steel tools.

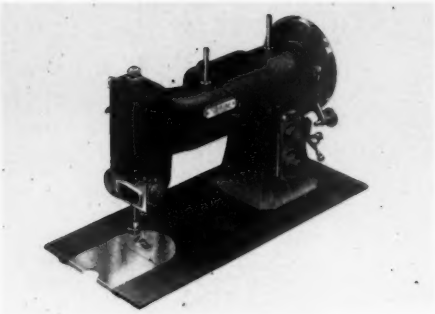
Dies with irregular shapes are best made by a build-up of inserts shrunk into a steel retainer. The use of inserts lowers the cost of fabrication over molded and lapped dies and permits the use of harder grades of carbide. Often corrections for wear or design error can be made by reworking any or all inserts and reassembling into a new steel jacket. Manufacture of insert type dies requires considerable technique and is not a method for the inexperienced or occasional builder of compacting dies.

Almost all carbide dies should be shrink fitted into their steel jackets. The degree of pre-stress must be determined by the application and design of the tool itself.

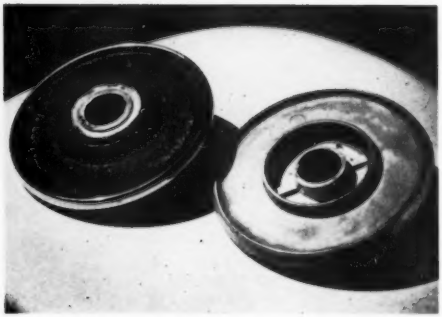
continued on page 74

*Eastern representative, National Carbide Die Co., and M. W. Parsons Plymouth, Inc.

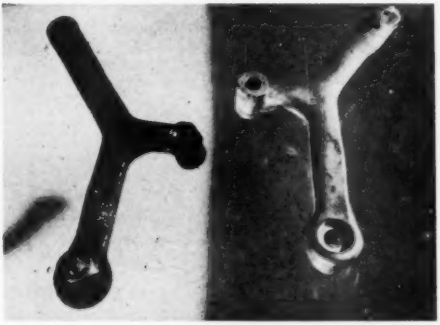
Here are the DIE CASTINGS used in White Sewing Machines



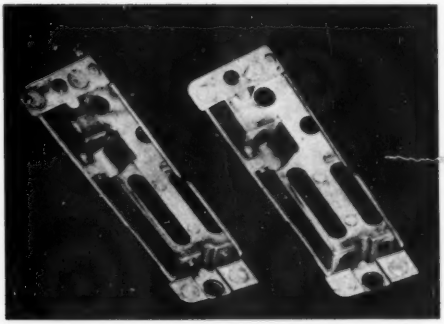
THREE PMM PROCESSES—die casting, investment casting and powder metallurgy—help to build this White sewing machine.



1. PROPER DISTRIBUTION OF MASS is accomplished by die casting this hand wheel in zinc alloy.

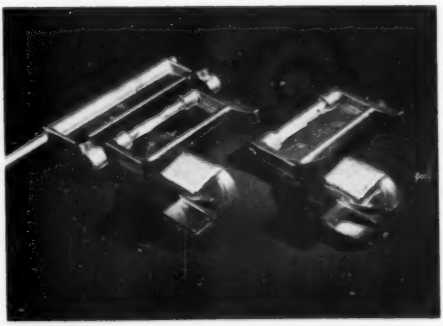


2. PAINT FIRST THEN MACHINE is the unusual sequence of operations on these components.



3. IT IS MORE ECONOMICAL sometimes to machine rather than to core holes to finish dimensions.

4. REPLACING CAST IRON, this zinc die casting is accurate in size and takes a good plate.



5. LOW INERTIA on a rapidly oscillating part is achieved by using aluminum die castings.

The White Sewing Machine . . a good example of design for MOLDED PRECISION PARTS

By LOVELL SHOCKEY
Product Development Engineer
White Sewing Machine Corp.

ALMOST any company with a moderately long history can trace, through evolution and growth of the product it makes, the developments in the metal forming fields; this is particularly true of the manufacture of consumer goods. The highly competitive nature of this field requires that the manufacturer constantly be alert to changes and improvements that might give him some advantage in cost or some increased sales appeal. Those companies engaged in making sewing machines for home use are good examples of this generalizaton.

For more than seventy-five years the White Sewing Machine Corp., of Cleveland, Ohio, has followed every new development in the fabricating of metals. As a process evolved from experimental stages to an accepted method of manufacture or metal forming, it was studied to determine where it could be used to help produce a better, quieter, more reliable sewing machine. Cost, of course, had to be considered but in many cases the improvements that accrued sufficiently outweighed any price differential so that in some instances a new process or product was employed, even though it meant a higher manufacturing cost.

The Precision Metal Molding processes are typical of the process of evaluation and change just noted. In chronological order of their appearance and use by White Sewing Machine Corp., the three PMM processes presently being employed to fabricate parts are die casting, powder metallurgy and investment casting. In the following discussion the changes that have been made over a period of years and the reason for the change will be given.

1. WHY DIE CAST THIS HAND WHEEL? —Acting both as a hand wheel and as a fly wheel, this part must have a high mass at the rim and a minimum mass at the center. As a sand casting in iron, the rim mass could be secured, but the web and hub section thickness had to be greater for an iron casting than for a zinc die casting to secure a sound piece. Finishing costs for a die casting are lower since only the bore and outside diameter need to be machined as contrasted with all-over machining on a sand casting.

Following machining, the wheel is chromium plated and then sprayed with a crackle finish lacquer. While the lacquer is still wet, it is wiped off on the rim and hub. Baking to produce the crackle finish completes the wheel. The die caster of this part is the Hoover Company of North Canton, Ohio.

2. PAINT FIRST THEN MACHINE is the unique sequence of operations on the bobbin winder frame shown. Originally designed as a die casting and made the Hoover Company, this part requires only surfacing operations to ready it for use.

Since its action must be easy so that the mild triggering action of the full bobbin will release the winder, even small amounts of paint or lacquer that might remain on bearing surfaces, cannot be tolerated. The cost of removing all vestigial lacquer is as high as a full mechining operation. For this reason, the zinc die casting is first lacquered and then the bearing surfaces are machined. The lacquer used is tough enough to withstand normal shop handling without being damaged.

3. PRECISE ALIGNMENT AND PERMANENT RIGIDITY are secured in the aluminum die casting used as a face casting. Because the needle bar bushings are mounted in the face casting, the tolerances for bore diameter and alignment are much too tight to be met by die casting. The White designers have, therefore, gone to the other extreme; they have opened the tolerances as far as possible to lower

the cost of the castings. The small amount of extra stock to be machined away because of these open tolerances costs so little more than the boring job that had to be done anyhow that an appreciable saving results.

The guide slot on the center boss would be a difficult die casting job. Here again, it is less expensive to mill the slot to the desired dimensions than to cast a rough slot and later finish machining it. The center bottom bushing, on the other hand, can be located with adequate accuracy during the die casting operation. It is, therefore, cast in as an insert. The presser foot guide holes are reamed and one of them threaded as finishing operations.

4. TO REDUCE DOWN TIME AND TOOL UPKEEP, the shuttle race cover shown is now a zinc die casting instead of an iron casting. The complexity of the machining operations can well be imagined on this part when every surface had to be machined. As now cast by the Doehler Jarvis Corp. (as is the face casting above), the amount of machining on this part has been reduced to a minimum. The lint cut is milled and one small hole drilled in the casting prior to nickel plating. After plating, the under surface is ground to provide a bearing for the shuttle. The shuttle itself is hardened and polished steel and is held in place by the race cover with a spring loaded device. Wear on the zinc die casting is negligible and good alignment is maintained by the spring loading device noted.

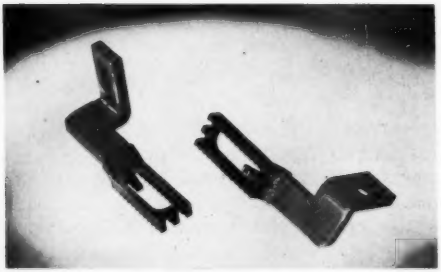
5. LOW INERTIA ON A RAPIDLY OSCILLATING part is secured through the use of a pair of aluminum die castings made by the Cleveland Hardware and Forging Co. of Cleveland, Ohio. This mechanism operates the cloth feed and since a rapid oscillating motion is needed, the weight should be kept as low as possible and still have a part with the necessary strength.

The shaft on the rocker part is knurled and cast as an insert in the die casting operation. Alignment for the rocker pins is secured by tapping the holes that are cored in the die casting. Drilling and tapping of the set screw holes complete this part.

The feed bar carries two press fit cup bearings and requires two milling operations to provide the dimensional accuracy needed. One of the milled surfaces carries, as can be seen, a ground steel bearing plate. This is needed where severe wear is encountered. Since the wear plate is hardened and ground, it is applied after the casting has been machined.

Here are the INVESTMENT CASTINGS used in White Sewing Machines . . . .

6. TWENTY-THREE SEPARATE OPERATIONS are currently being eliminated by the use of one investment casting. The feed shown is investment cast by Midwest Precision Casting Co. of Cleveland, Ohio, in 1018 steel and as received from the vendor, is ready for hardening.



6. INVESTMENT CASTINGS permitted the elimination or reduction of many secondary operations on this feed element.

The old feed required some 23 operations, of which 9 were bench work and the balance on machines. Much of the machine work involved blanking, trimming and forming dies with excessively high tool upkeep. Many of the tools used had to be maintained in duplicate so that one set of tools could be in use while another set was in the toolroom being reconditioned. While such a condition is intolerable, the shift to an investment casting has not, in this case, realized any appreciable saving in manufacturing cost. The use of the cast feed is relatively new but there is reason to believe, however, that the part will eventually be made at a lower cost than previously.

Even if the cost of this feed is permanently higher than its formed and machined counterpart, the decreased load on the toolroom may well justify the continued use of an investment casting for this part.

Here are the POWDERED METAL PARTS used in White Sewing Machines . . . .

7. INSTEAD OF A HOLE DRILLED IN THE IRON CASTING, the modern sewing machine makes use of bronze and iron self-lubricating bearings made from metal powders. Through the use of these bushings longer life, lower sound level and better alignment are secured.

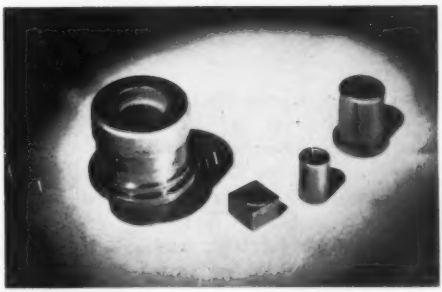
In the illustration, bushing is a porous bronze self-lubricating forward bushing. It replaces a cast iron bushing previously used and on accelerated life test, showed no appreciable wear or increase in noise level after the equivalent of twenty years of normal use; far outperforming a cast iron bushing in the same application.

As made by the Keystone Carbon Co., of St. Marys, Pa., this bushing has the recess machined after molding and sintering. The press fit outside diameter is relieved somewhat at the points where maximum pressure occurs when the bearing is pressed into its housing. This relief prevents collapse of the porous structure onto the shaft and subsequent binding.

This bushing must also function as a thrust bearing; and end faces, therefore, are machined to secure absolute perpendicularity with the bore and a flatter face then is secured by the fabricator. Overall length tolerances are close and rather than hold the vendor to a super tight requirement, the length is adjusted when final machining is done.

Cost of this bushing is higher than the one it replaces, but as noted above, the improvement in performance outweighs the cost increase.

In discussing the face casting, attention was called to the precise alignment that is required. After the bearing holes have been bored, two self-lubricating bushings are pressed in. These bushings, made by the Bound Brook Oil-Less Bearing Co. of Boundbrook, N. J., are a standard self-lubricating bronze. They are used only in those machines having an aluminum or magnesium casting for the face. When either of these two metals is used, there has been galling of the bore by the steel needle bar. These bushings are considerably more expensive than the older method used when the casting was



7. QUIETER, LONGER-WEARING and easier to align, powdered metal bushings have improved the performance of today's sewing machine.

iron, but are essential if an aluminum die casting is to be employed.

One lightweight line of machines utilizes magnesium sand castings for the main frame members. When these casting are used, it is not possible to allow the magnesium to function as a bearing material also. The rear insert bushing is, therefore, made of powdered iron by the Wel-Met Company of Kent, Ohio. The use of this bushing represents an increase in cost over the bushing used when a cast iron frame member is employed, but as in the case of the needle bar bushing, is required for the magnesium frame.

A portion of the mechanism which transmits motion from the main crank to the lower shaft is the slide block shown. As a portion of the main drive of the sewing machine, the slide block is subject to almost the maximum amount of wear of any part on the machine. In addition, it is one of the few rather highly stressed parts on a sewing machine. Replacing a steel slide block, the self-lubricating bronze block costs about the same as the older one.

Through the use of porous bronze, better wear, sizing and finish are obtained in addition to the self-lubricating features. As made by the Precision Metal Products Co. of Ellwood City, Pa., the slide block is held to a tolerance of ±0.001 and is slightly oversize for the channel

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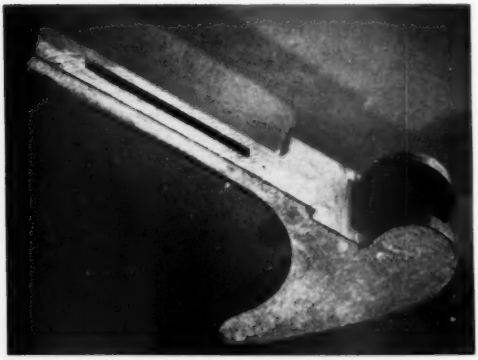
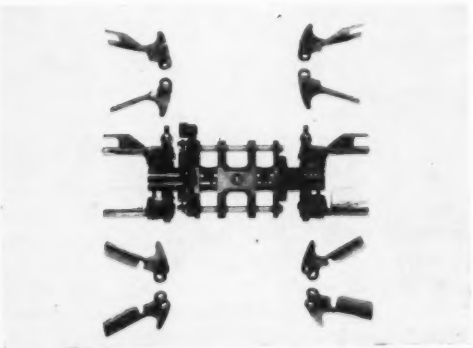
Designer-foundry collaboration uses advantages of PLASTER HOLD CASTING

By J. B. SAVITS
Chief Engineer
Pneumatic Scale Corp., Ltd.

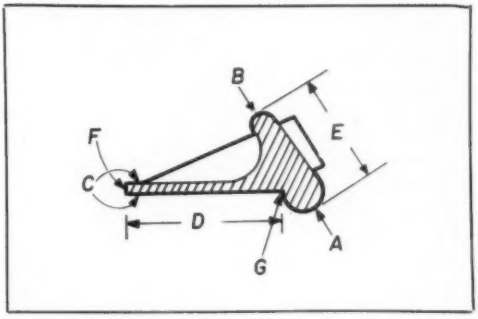
(EDITOR'S NOTE) PRECISION METAL MOLDING believes that the importance of consultation between the vendor and the purchaser of parts made by the precision processes cannot be overemphasized. Full advantage of the potentialities of the different processes cannot be secured unless both parties discuss what can and cannot be done or tolerated. The experience of the Pneumatic Scale Corp. in working with their vendor to exploit most fully the the plaster mold casting process to obtain precision elements is a good example of this cooperation. Over a period of five years, redesign by the purchaser and development by the vendor have been carried on so that today the parts made by Ohio Precision Castings Co. take advantage of practically every short cut and advantage of this particular casting process.)



1. SUPERIOR ACCURACY and stability from piece to piece made plaster mold casting the preferred method of making this gripper finger.



2. INTRICACY and a high degree of variability of design were both easily encompassed by the plaster mold casting process to make this group of gripper fingers.



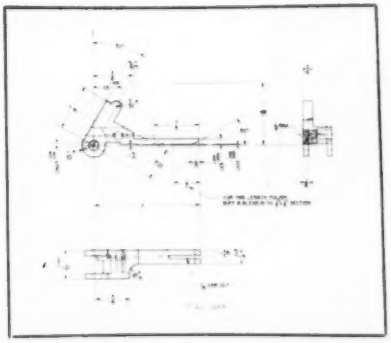
3. JIG FOR GAUGING the fingers is made so that only those surfaces which the foundry must hold critically are contacted by the fixture. All others are either non-critical or must be finish machined so that the vendor need not be closely held to size tolerances. See pages 40 and 41 for detailed explanation.

SOME tea bags have strings attached to them and some have none. To hold the filled bags while the string is attached requires a variety of differently shaped and different sized gripper fingers as shown in Figure 1. In exploring the many possible methods of manufacturing that could be used to make these gripper fingers, the Pneumatic Scale Corp., Ltd., of Quincy, Mass., finally decided on plaster mold castings of manganese bronze as the most practical and economical method for their purpose.

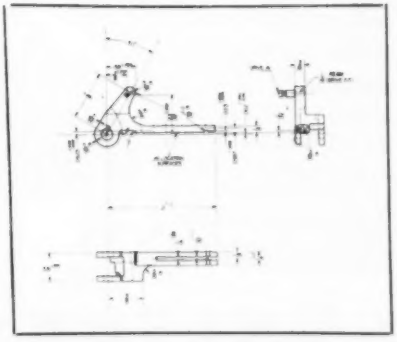
In considering the various casting methods to replace machining the fingers from steel stock, consideration had to be given to the number of pieces involved in each design, the amount of machining that had to be done on the castings after they were received from the foundry, the precision with which the foundry could hold dimensions, the accuracy of duplication from piece to piece, and finally the finished piece cost of the fingers ready to be installed in a machine.

One of the gripper fingers, as designed for machining from steel stock, is shown below. Some of the dimensional tolerances called for in this drawing could not be maintained by the foundry and the general design was not well adapted to casting. It became necessary, therefore, to do some major redesigning. The 0.199 diameter holes, for example, had to be held to very close tolerances as to size, alignment and location. If cored, they required a large amount of cleanup stock to assure proper alignment and the drilling and reaming operation became costly, and giving rise to considerable scrap. The best solution was then to drill and ream these holes as a secondary operation.

For machining purposes, it was necessary to mount the finger in a jig. This required the establishment of jig locating surfaces. The flat under-face of the finger and the 3/32" radius were chosen for these locating surfaces. Once these surfaces were set, the tolerances on them



4. ONE OF THE GRIPPER FINGERS as originally designed to be machined from steel stock. The shape was not well adapted to casting and tolerances were too tight for the foundry.



5. THE REDESIGNED GRIPPER FINGER. Specifically designed for the plaster mold casting process with defined locating surfaces and dimensional tolerances that the foundry can hold.

both as to size, flatness or accuracy of curvature had to be the closest that the foundry could achieve; all other dimensions had to be related to these jig locating surfaces.

Some of the problems that had to be solved bear documenting.

GATING LOCATION CHANGED. The recess in the bottom of the casting is used as a stop in the finger operation; therefore, it had to be held closely. This same area was selected by the foundry as the most desirable ones at which to gate the casting. Early castings were gated at this point but accuracy of size and shape could not be maintained without unnecessary machining. The pattern was redesigned to be gated at another point and the recess was successfully cast to the desired accuracy.

ALLOWANCE FOR CLEANUP. The slot in the finger is required to be very smooth. Originally, this slot was cast to size, but experience showed that the surface was not adequate. The core was, therefore, changed to allow for 0.010 cleanup after casting.

IMPROVING STRAIGHTNESS. Straightness of the finger is obviously a prime necessity. Some of the earlier castings came through with a slight curvature. Checking of the master patterns and molds failed to show the cause of this curvature. Finally, it was found that the temperature at which the casting was removed from the mold was one of the factors that determined the degree of flatness of the finger. A proper time cooling cycle was established and the major troubles with lack of straightness were minimized.

EFFECT OF CHILLS. For good foundry practice, it was necessary to use steel chills at some points. These chills usually left a burr on the casting when they were removed. Where these burrs occurred, it was difficult to hold dimensional tolerances. In some cases, it was possible to loosen the tolerances to accommodate and in others minor redesign of the part was made so that the previously specified accuracy was no longer needed.

When most of the troubles had been ironed out and the master patterns were set, gauges for each finger design were made. These gauges, to be used by the foundry, were designed to check only the critical foundry dimensions and surfaces. No others contacted the gauge so that the chance of confusion was greatly reduced and the inspection load lowered. A

continued on page 41

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There must be a reason why so many highly discriminating manufacturers entrust *all* of their work to us. The reason is they *know* from experience that the finished job will meet every specification as to appearance, strength, accuracy and function. Furthermore, the price on either long or short runs is in line with their production and selling costs.

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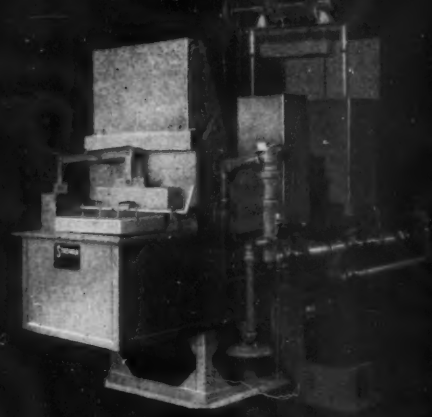
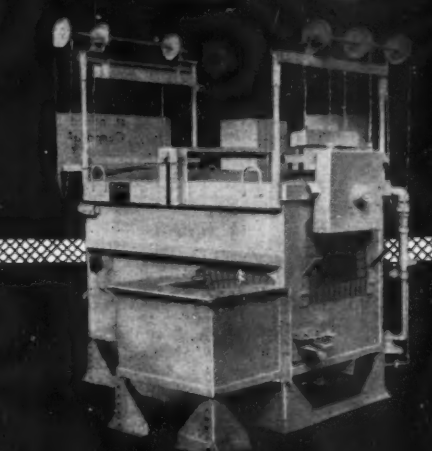
NEW STROMAN DOUBLE CHAMBER "DC" ALUMINUM MELTING FURNACE

For Die Casting • Sand Casting or Permanent Mold Plants

Rear and side view Showing Charging Door



Front and side view Dip-out well in front



Front and side view Dip-out well on side

This revolutionary type furnace for melting and holding aluminum is composed of two separate chambers combined into a single unit. One chamber is for melting only, where the ingots or returns are completely covered by flame as they are fed into the charging door and all capilatory moisture is driven out before the metal melts and runs into the holding chamber. Metal usually flows into the holding chamber at between 1160—1180 degrees. Cold, or moist metal NEVER reaches the molten bath. This eliminates gas pick-up and the resultant fault . . . porosity. The holding chamber is heated separately from the melting chamber to assure correct pouring temperature. Both chambers have automatic temperature controls, to eliminate manual miscalculations. Metal in the holding chamber can be controlled to within plus or minus 10 degrees, as it is constantly fed from the melting chamber with metal of a constant temperature.

Another outstanding feature is that it eliminates hard spots in the molten bath, and the bath can be held day in and day out without tapping, and show no ill effects. With a "DC" Aluminum Furnace you can do away with the tasks of tapping and making ingots at night and time wasting heating-up in the morning. Fuel costs for keeping metal at correct temperature overnight are negligible in comparison to time wasted in the old way. Man hours are costly and hard to find . . . conserve them!

An exclusive feature that die casters and permanent mold founders will find a great convenience and economy is the fact that REJECTED CASTINGS CONTAINING INSERTS can be remelted in the "DC". It sweats the aluminum off the insert in the melting chamber and leaves the insert where it can easily be raked out of the charging door.

Separate melting and holding in one unit also keeps fuel costs at an astounding low . . . as metal does not lose temperature in transport from melting to holding furnaces and there is no preheating of holding crucibles. With a "DC" constant, efficient, flawless and most economical castings are assured.

Capacities range from 700 pounds a molten bath up. Gas, Oil, or Combination Gas-Oil Fire.

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Section View of Stroman "DC" Furnaces

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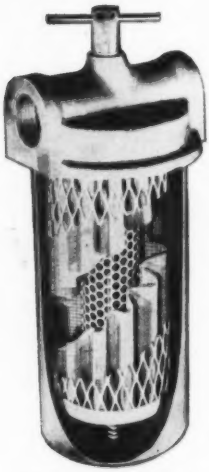
PROTECT HYDRAULIC EQUIPMENT

SUMP TYPE (cutaway)

with

MARVEL SYNCLINAL FILTERS



LINE TYPE (cutaway)

DEPENDABLE PROTECTION in HYDRAULIC and LOW PRESSURE SYSTEMS

With the ever increasing demand for more production from new and existing machinery, Marvel Synclinal Filters are playing an important part in converting maintenance "down-time" to increased "producing time".

LESS MAINTENANCE

Because Marvel Synclinal Filters may be disassembled, cleaned and reassembled in a matter of minutes by any workman, filter maintenance "down-time" is reduced to the absolute minimum.

GREATER EFFICIENCY

Because of the combined, outstanding features, in both construction and performance, Marvel Synclinal Filters bring about the greatest degree of efficiency in all production equipment where filtration of liquids is of the utmost importance.

MORE PRODUCTION

The balanced synclinal design of Marvel Filters leaves plenty of space for storage of foreign matter, without flow interference or pressure build-up. Therefore longer periods of productive operation are attained.

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Because engineers decided on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety—

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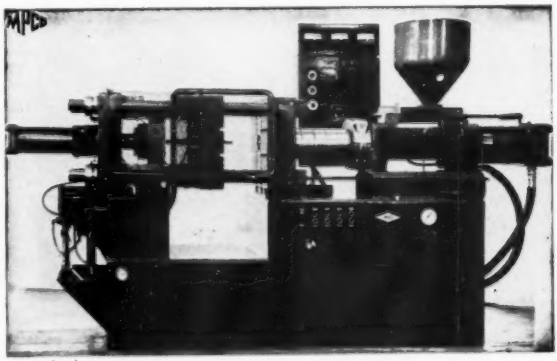
Marvel Filters are available in sump and line type models, in capacities from 5 to 100 g.p.m. and in monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe fittings. For efficient filteration of liquids in all HYDRAULIC and LOW PRESSURE systems investigate Marvel Synclinal Filters.



IMPCO HA4-175 4 to 6 Oz. Plastic Molding Machine. Marvel Synclinal Filters protect the hydraulic systems in Impco's complete line of molding machinery, and are installed as standard equipment. Photo courtesy Improved Paper Machinery Corporation Nashua, New Hampshire.

★ **WATER FILTERS** In response to the great demand, we have designed both our sump and line types for use in all water filtering applications.

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typical gauge made for this purpose is shown in Figure 3. In this figure, the gauging points and surfaces which the foundry must hold are indicated:

A and B	Both radial contours
C	Thickness of the finger
D	Overall length of the finger
E	Distance between ends of radii
F and G	Critical contact points

With these gauges, the foundry has been able consistently to deliver satisfactory castings.

The changes, some of which are noted above, finally resulted in a finger of considerably different design and with different accuracy concepts. The final design is shown in Figure 5.

The amount of development required has paid off because the decrease in cost is, in this case, outstanding.

Cost of manufacturing fingers from machined steel stock, the method established in 1944, see illustration Figure 2, has been reduced 74% with the adoption of the plaster mold casting process. This saving, which is based on 1944 valuations, represents not only several thousand dollars in actual production costs, but considerable reduction of the burden on installed machine tool capacity. The Company has been compensated for the difficulties encountered many times over.

One further point should be made in connection with this review of redesign. This foundry was able to deliver over the entire period of adjustment, adequate numbers of castings which, in spite of some extra machining, were usable and in all cases, cost less than the completely machined fingers.

Electrolytic iron powder, produced by Plastic Metals, is now being used by Presmet Corporation, Worcester, Mass., for making impeller blades for the flywheel of the Westinghouse "Waste-Away" garbage disposer.

Formerly these double-edged blades were high-carbon, high chromium alloy steel castings which required annealing and six expensive machining operations. The part, as designed, was perfect for compacting, its uniform thickness presenting no difficult tooling or pressing problems.

Electrolytic iron powder, chosen because of its superior properties, is compacted, sintered and then infiltrated with a copper alloy in a controlled atmosphere electric furnace. Costly machining operations are completely eliminated.

As a practical wear test—after three months continuous operation in a cafeteria waste disposing unit (where waste from some 1200 meals per day are disposed of in this equipment), the metal powder impellers were found to be in excellent condition.

You may have a product where the use of a metal powder part will result in a similar production cost saving . . . or where scarcity of metals may now be holding up production. We shall be glad to put you in touch with experienced fabricators who will work with you and advise you reliably on whether your problem may be solved with metal powders.

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Diaphragm Core for Pneumatic Timing Relays, accurately die-cast of zinc alloy, to extremely close tolerances.

Pneumatic Timing Relay produced by the Square D Company for industrial control applications.

Diaphragm Cores for Pneumatic Timing Relays are Die Cast by *MILWAUKEE*

Pneumatic timing relays, such as the one pictured here, are used primarily for precision control in industrial applications. Normal variations in voltage, ambient temperature and atmospheric pressure have little or no effect on the accuracy of the time.

A vital component of several Square D pneumatic timing relays is the zinc die-cast diaphragm core which houses the pneumatic control, key to the precision operation of the entire assembly. For example, the tapered hole which accommodates the needle of the valve assembly must be absolutely concentric and in perfect alignment with it at all points, in order to insure accurate functioning of the pneumatic timer. Faithful reproduction of the engineering design, and extremely close dimensional tolerances are other basic requirements.

MILWAUKEE Die Casting Co. is proud of its long association with manufacturers of electrical control equipment as a dependable source of supply for precision die castings. The experience and knowledge acquired in fulfilling their requirements is of great value in the design and production of precision die castings for any purpose.

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A 7158-2/3

NEW ALUMINUM-PLATING PROCESS USES METAL HYDRIDE; USE IN ELECTROFORMING

A practical process for electrodepositing aluminum at room temperature has recently been developed by D. E. Couch and Abner Brenner of the National Bureau of Standards. Dense, ductile deposits of the metal are being obtained at the Bureau from a type of organic plating bath consisting of an ether solution of aluminum chloride and a metal hydride. The new bath is expected to find important application for electroforming articles with close inside tolerances, such as waveguides, and for various types of equipment with a thin protective coating of aluminum.

Because aluminum is so far above hydrogen in the electromotive series of the elements, it has never been deposited from aqueous solutions, which always contain some hydrogen in ionized form. Aluminum is usually produced commercially from a bath of fused cryolite and aluminum oxide. However, this process must be carried out at a high temperature, and the metal is obtained in a fused state, unsuitable for electroplating or electroforming. Electrodeposition from nonaqueous solutions has been tried in the past, with some success, but the procedure was too difficult for practical applications, and the deposits were lacking in purity, ductility, and other desirable qualities.

The National Bureau of Standards is now conducting extensive research in an effort to develop methods for depositing in good physical form unusual metals such as molybdenum, tungsten, titanium, and zirconium. Both fused salts and baths of organic solvents are being investigated. One of the first metals studied was aluminum. The success of the aluminum plating bath, developed in the course of this work, may be expected to give added impetus to the current widespread efforts to obtain other metals in pure form from nonaqueous solutions.

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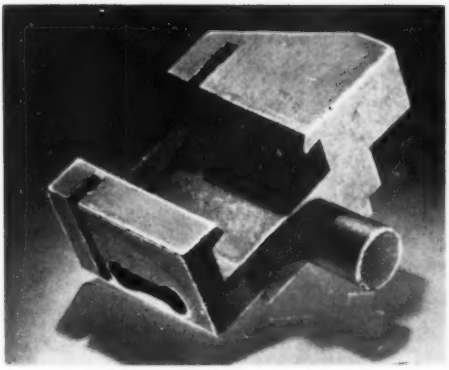

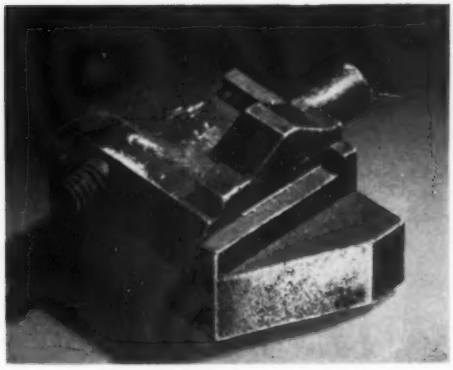

REPLACEMENT OF A PLURALITY of machined parts by one investment casting is one of the best reasons for using the process. When this unification can be combined with better surface and closer dimensional tolerances at a market saving in final cost, the use of investment casting to make parts such as this margin stop is amply justified.

Component inventory reduced by INVESTMENT CASTING

TYPICAL of the savings possible when one investment casting is substituted for a plurality of machined parts assembled by brazing is the the typewriter margin stop shown above.

This margin stop was originally designed to be made from four parts machined from steel bar stock and then brazed into a single assembly. Tolerances on the part are close, ± 0.003 per inch, so that on some dimensions the maximum allowable deviation is less than ± 0.0015. During brazing the possibility of misalignment and warpage were great and the 0.030 slot had to be cut after assembly.

Even under the best conditions the small stud required either complete threading or a clean up operation after assembly and the slide groove had to be milled to hold it to the required dimensional accuracy. The complexity of this assembly operation coupled with the accuracy and stability of dimensions that is required resulted in high inspection losses.

The conversion to investment casting as a manufacturing method has eliminated all but two machine operations and has resulted in a margin stop that is stronger and more uniform in both shape and size.

Because of the complexity of the piece the Rode Co., of Woburn, Mass., the fabricators, have selected beryllium copper as the metal in which to cast the stop. At normal casting temperatures, beryllium copper is highly fluid and gives castings that are exceptionally accurate in detail. The high fluidity also allows casting of narrow slots, small holes, and sharp corners.

Functioning as it does, this part is subject to considerable impact and must, therefore, be rather hard. Here again, the use of beryllium copper is desirable since it age hardens adequately. In this case, the casting after being received from the foundry has to have the small stud threaded and a clean-up cut taken through the guide slot. After these two relatively simple operations the part is hardened to 35 or 40 Rockwell C.

The reduction in cost of the finished margin stop, as investment cast and hardened is considerable.

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METALLURGICAL HANDBOOK REVISED

To aid metallurgists faced with new production problems in a defense economy, a new edition of "Practical Metallurgy for Engineers" has just been issued by the Research Staff of E. F. Houghton & Co.

This fifth edition represents more than a year's work of revision and checking to bring the previous edition up to date. It presents the latest standards and practices followed in the metal industry today and includes also a discussion of probabilities relating to new metals, new alloying elements and new types of heat treatment. The sections of the book covering heat treating are said to be among the most comprehensive published.

The revision has 120 pages more than the previous (1943) edition. New chapters include one on flame and induction heating to bring in new developments which have expanded the useful range of both these methods. Following the chapter on carburizing, the revision also contains a new chapter on "Other Surface Hardening Methods". The chapter on "Heat Treatment of Aluminum Alloys" has been expanded to "Heat Treatment of Non-Ferrous Alloys" in order to include magnesium and copper alloys as well as aluminum alloys.

In addition, revisions have been made throughout the book to incorporate the latest methods and data related to all phases of metallurgy, including the latest AISI steel classifications.

Since its first edition in 1923, the book has been a standard guide in the industry. The new edition is well printed and well illustrated, contains 599 pages, and sells for $3.50. For further information write to E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

PMM

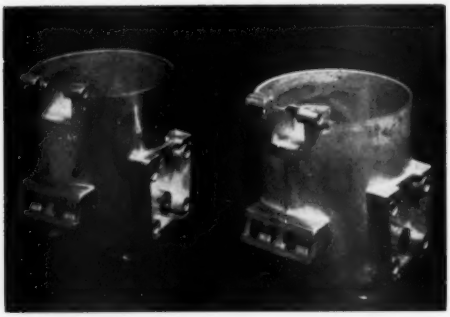
Finishing Section

SURFACE FINISHING

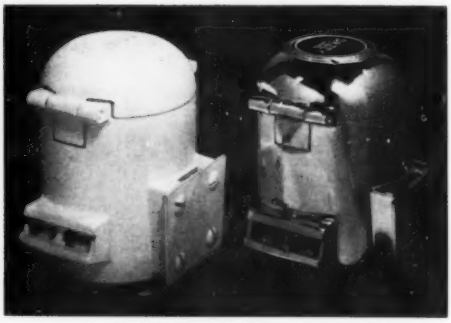
Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
Permanent Mold Castings • Plaster Mold Castings



TWO STAGES in the finishing of a zinc die casting are illustrated above, with the raw casting as received, right, and as polished and buffed preparatory to painting or plating at the left.



ALTERNATIVE FINISHES applied to the die cast zinc ice crusher body are copper-nickel-chromium plating, as illustrated at the right, and painted with a baked white gloss enamel, left.

Choice of plated or painted finish for DIE CAST ZINC surfaces.

FEW surfaces are more difficult to chromium plate properly than a plain, unornamented surface on a zinc die casting. This is even more of a problem when the die parting lies directly across such an area, requiring removal of flash without marring the dense "skin" or altering the contour.

The Dazey Corporation, manufacturers of kitchen appliances, have one such die casting in regular production and have been successful in getting a high quality chromium plate with somewhat less than one percent of plating rejects.

The same casting is alternatively finished with a baked, white, gloss enamel.

The casting is the deep, cylindrical-shaped housing for an ice crusher, whose smooth outer surfaces must meet the critical scrutiny of every prospective customer. The plating and painting cycles being employed by Dazey in its own finishing department are reviewed here.

To get a quality finish demands close attention to detail at every stage of the process, from the original design of the part until it emerges from the final chromium tank and is dried. Of particular importance is the work of the die caster because nothing less than a "hardware finish" as cast will give satisfactory results. The castings discussed here are produced by the Rupert Die Casting Company of Kansas City.

"Hardware finish" on castings such as the ice crusher body, shown in the as-cast condition in Figure 1, is difficult to achieve. A plain, cylindrical surface, free of fluting, beads, ribs or other features, is most likely to reveal every slight blemish caused by uneven chilling of the molten metal.

Furthermore, this is a casting having unequal sections and complex side coring which tend to interfere with the smooth flow of metal as it enters and fills the die cavity. Finally, the design of the piece is such that it is necessary for the die to be constructed so that the die parting lies vertically along the side walls of the cylinder where any subsurface porosity left by an oversized flash root would be impossible to polish out or conceal.

Problems arising from this simple-appearing shape are not easy for the die caster to overcome, but they are equally troublesome for the plater who processes the casting. The clean, streamlined shape which answers the needs for sales appeal and ease of cleaning, presents many special complications for the plater, including: 1) retention of liquids in recesses and holes so that the drag-out contaminates the plating baths, 2) design of plating racks so that current distribution is adequate and castings can drain completely, 3) removal of parting line so that it doesn't show, 4) danger of polishing so deeply that pores are opened up, and 5) polishing of the cylindrical shape so that no "flats" or other deviations are formed.

Bath contamination. Some drag-out cannot be avoided, but Dazey Corp. has set up a system of purification by electrolysis and filtration. Copper and zinc contamination is removed by passing steel sheets through the plating line so that metal contamination plates out. Every second month, the solution is pumped from the tank and filtered. Regular analysis of plating solutions is made to determine bath additions.

Rack design. Design of plating racks is a specialty of this plating department, and credit

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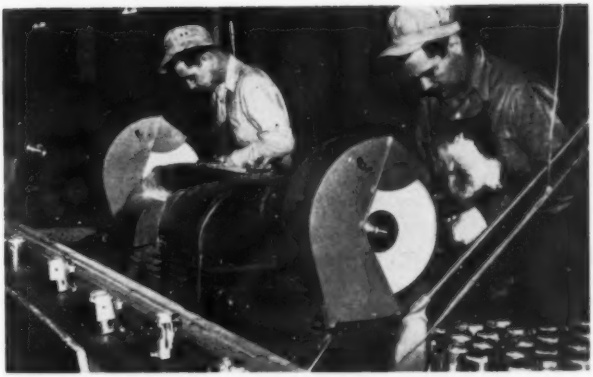
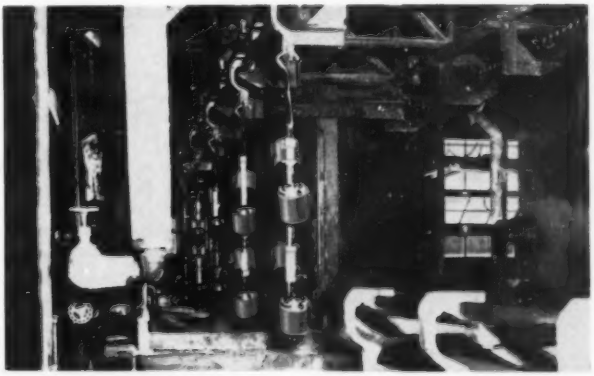


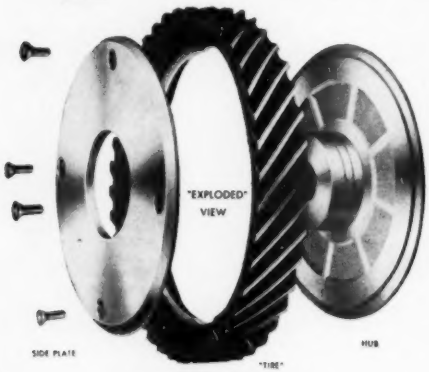
PRESERVATION OF THE CAST SURFACE is essential to the success of polishing and buffing. The less metal that is removed, the better the quality of final surface.

PREPARATION FOR PLATING includes a vapor degreasing, electrocleaning and acid dip, while the painted surface requires a preliminary mild alkaline cleaner, oxalic acid dip and phosphate type treatment.



COMPLETELY AUTOMATIC electroplating with a Udylite automatic setup is used for the nickel and chromium cycle.

2 Outstanding New Abrasive Developments



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World's first portable *belt* grinding attachment, a brand-new abrasive idea — ideal work-speeder and money-saver on die and mold grinding, weld clean-up, edge-breaking, contour finishing. Fits most any straight spindle portable tool, electric or air — easy to attach. Light — compact — handy in close quarters. On many jobs, it eliminates 2 or 3 separate abrasive operations.

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for the low rate of rejects is largely attributed to the practice of avoiding overcrowding of racks. Any attempt to hang as many castings on a rack as can be physically accommodated is likely to increase the number of rejects due to improper current distribution, excessive gassing, poor inside throw, insufficient drain and causing many defects such as shading, uneven plate thickness, streaking, etc. By designing racks for a moderate number of castings, the maximum percentage of acceptable pieces is produced.

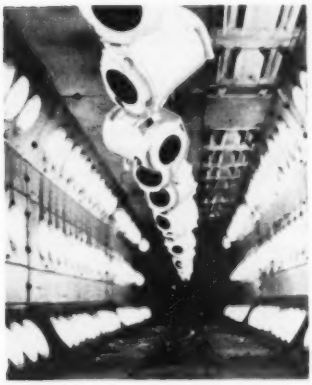
Polishing techniques. The skill and experience gained by years of polishing and buffing die castings account for the techniques used for removing parting lines and minor surface blemishes. There is no formula for success in this department except a general rule that the less metal removed, the better will be the results.

It is sometimes possible to make minor changes in the original design of a part to facilitate polishing and buffing. The same thing is true with regard to plateability. For this reason, familiarity of the product designer with some of the details of finishing technique may enable him to overcome some problems by a slight change in contour, the provision of a bead or embellishment at a particular location or some other variation.

Plating cycle. The complete chain of finishing operations from the time a raw casting starts down the line until it emerges as a chromium-plated component of an ice crusher, is as follows:

1. Remove the parting line using a 120 wheel.
2. Color buff with a 220 grease wheel.
3. Clean with trichlorethylene vapor degreaser.
4. Electroclean with reverse current in one-to-three ratio

continued on page 53



INFRA-RED BAKING makes the enamel coating hard and durable on these ice crusher bodies. Cycle takes 7 to 10 minutes at 300-400F.

in BURNISHING MATERIALS

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Thousands of small parts, stampings and castings are burnished quickly and efficiently with Abbott Burnishing materials. They're shaped to do the job *right!*

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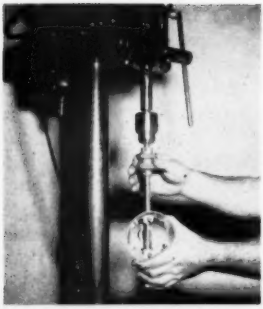
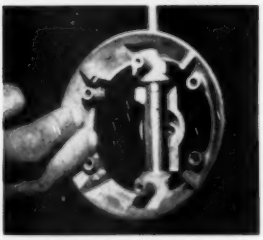




BURRS ON DIE CASTINGS can be removed whether inside or outside, as demonstrated by the photos, above, showing the tool installation. The closeup shows the cutter blade ready to deburr an inside hole.

Removing burrs and flash from round holes rapidly by new method

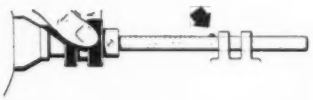
ONE of the universal problems connected with the finishing of die castings is the removal of burrs and flash from around holes, especially those formed by moveable cores that always result in a light ring of flash. This usually involves a slow, tedious and wasteful hand operation with small file or snagging tool.

A recent development which promises to speed up the removal of such burrs on round holes in die castings is a new type of burring and chamfering tool. It fits any lathe or drill press.

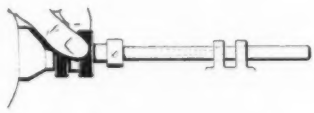
This tool, produced by NoBur Manufacturing Company of Burbank, Cal., removes burrs on outside surfaces, inside surfaces or both, using the same tool. Drawings at right illustrate the manner in which the tool deburrs die cast components. It should be noticed that the cutter blade can be moved along the spindle to remove a succession of burrs without stopping the machine. The adjustment is made by means of a knurled sleeve which is free wheeling on ball bearings.

The tool is made in standard sizes from 3/16″ to 1″ in 1/16″ increments, and intermediate sizes from 7/32″ to 15/32″ in 1/32″ increments. Other hole sizes can be furnished to meet specifications. The pilot shaft is heat treated alloy steel ground to high degree of surface finish and to a diameter slightly under the basic hole size for which the tool is listed.

How deburring is done . . .



1. Insert Nobur tool in any machine spindle. Slide work piece over tool shaft . A light pressure against the revolving cutter blade quickly deburrs the outside surface of the work.



2. After outside surface is deburred, slide knurled sleeve back to retract blade.

3. With blade retracted, move work piece for deburring inside surfaces. Raise (project) blade and bring work up against double edged cutting blade to deburr first one surface, then the other.

PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

TUMBLING-PLUS-ABRASIVE BLAST

Airless Rotoblast Barrel, Type GN
Pangborn Corp.

SPECIAL FEATURES: High cleaning efficiency for processing castings by means of a combination of tumbling and abrasive blasting. Abrasive loss is eliminated by specially-developed abrasive-tight door and housing.

SPECIFICATIONS: Newly designed work conveyor driven by hardened steel chain uses special cast ductile iron slats which will not pinch the work; conveyor slats turn on the pitch line of the sprockets so that distance between slats is always the same at any point of travel.

Drive is by means of V-belt to spur gear reducer mounted directly on work conveyor shaft. When barrel is operated, conveyor travels upward to tumble castings; after cleaning, conveyor direction is reversed & load discharged into the work loader.

Abrasive-proof door is woven wire mesh backed by vulcanized rubber & slides on rollers in a mechanized labyrinth. During barrel operation, cleaning & reclaiming system works constantly.

Drive motor is 1½ hp; dimensions for 6 cu. ft. unit —6'8" x 6' wide x 13'9⅞" high; dimensions for 12 cu. ft. unit—7'9" x 9'7" wide x 14'6" high.

For additional information circle No. 196 on Reader Service Card

CUP GRINDING WHEEL

U. S. Royalite Hard-Shell Cup Wheel
United States Rubber Co.

SPECIAL FEATURES: New type cup grinding wheel retains its sharp cutting edge throughout its service life. Wear occurs evenly across entire wheel face.

SPECIFICATIONS: Wheel has hard shell of tough resin-bonded abrasive built around a core of rapid-cutting resin-abrasive construction. Shell is 3/16" thick, resists mushrooming or rounding of the wheel's cutting edge. Overall diam. 6" to 4¾"; thickness is 2"; available for 3 standard types of arbors.

For additional information circle No. 197 on Reader Service Card

SMALL-VOLUME ELECTRIC MELTING

GMS furnace
Detroit Electric Furnace Div.
Kuhlman Electric Co.

SPECIAL FEATURES: Redesigned to produce quality melts of alloy irons, tool steel & stainless steel in small quantities for investment casting, limited run production and laboratory use. Simple design & ease of manipulation are features.

SPECIFICATIONS: Furnace rated at 60 lbs. capacity, operates at 30 kw. Three-phase reversible motor has replaced the single phase motor formerly used and causes rocking action during melting, and tilts the furnace for pouring.

Electrode brackets are mounted independently of the shell to allow easier, faster shell replacement & minimize wear on the flexible electrical leads. Type GMS furnished complete with transformer ready for installation in the foundry. Overall width is 65½", maximum electrode length 42", and 54" is required for withdrawal of full length electrode. Transformer & control panel stands 79¾" high.

For additional information circle No. 198 on Reader Service Card

WET BLAST FINISHING MACHINE

Abrasive Wet-Blast, Inc.

SPECIAL FEATURES: Close tolerance finishing of dies, molds, tools and other metal products by a blast of abrasive suspended in water. Simple operation requires no special skill on the part of the operator. Metal removal is negligible.

For additional information circle No. 199 on Reader Service Card

continued next page

NEW PRODUCTS (continued from page 51)

BRAZING "HARD-TO-WET" CARBIDES

"EB" Silver Brazing Alloy

Handy & Harman

SPECIAL FEATURES: New metal joining composition intended for brazing chromium carbide, cast carbide & other "hard-to-wet" carbides. Effective results also reported on high tungsten-copper alloy, cer-mets and other refractory alloys difficult to braze.

SPECIFICATIONS: Composed of 57% silver with the balance made up of copper, manganese & tin. Melting point is 1120 F and flow point 1345 F. There are no volatile elements, an important factor in vacuum applications, and it is non-susceptible to dezincification type of corrosion. Has been used successfully on type 316 stainless steel subject to dilute mineral acid corrosion.

For additional information circle No. 200 on Reader Service Card

COLD CEMENT FOR WHEELS & BELTS

"Grip-Grain"

Schaffner Mfg. Co.

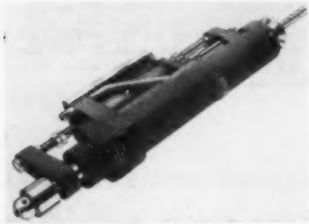
SPECIAL FEATURES: Cold cement for polishing wheels & abrasive belts used for grains from 20 up to 320 & requires no special preparation to salvage worn-out wheels or belts. No heat required for drying. Cuts down time required for wheel changes. Greater adhesive action "locks" emery grain to surface, and is odorless. Testing quantities of the cold cement are available from the manufacturer.

For additional information circle No. 201 on Reader Service Card

AIR POWERED DRILL UNIT

Gurmendi Air Drill Unit

Alkon Products Corp.



SPECIAL FEATURES: Universal application in set up & power choice, full control of stroke & speed of feed, positive adjustment for forward & return strokes, simplicity of operation & maintenance.

SPECIFICATIONS: Stroke full 2" with controlled feed of 1¼"; Control of feed rate is taken over at any desired point in spindle travel by hydraulic monitor giving fully adjustable rate. All bearing surfaces standard items; spline pulley mounted rigidly in housing with ball bearings; spindle equipped with ¼" capacity Jacobs chuck.

For additional information circle No. 202 on Reader Service Card

Is your washing machine cleaning brass, aluminum and zinc die castings as well as it cleans steel? Do the nozzles clog too often? Is there too much foaming?

Oakite has developed cleaning materials that meet every requirement for washing metal in every type of machine.

You'll want to read the Oakite booklet on washing by machine —16 pages of suggestions like:

¶ How to select the best detergent. When to use a solvent. When to use alkali. *See pages 4 to 8.*

¶ How to prepare metal for painting. *See page 9.*

¶ Tips on selecting and operating washing machines. Special instrument aids to better operation. *See pages 10 to 13.*

FREE For a copy of "*8 things to look for when you wash metal by machine,*" write to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

OAKITE

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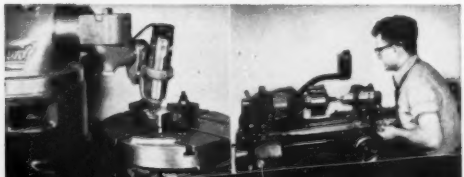
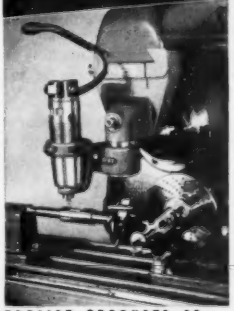


LOWEST COST PRECISION FOR TOOL ROOM AND PRODUCTION



ONE PORTABLE MULTI-PURPOSE PRECISE GRINDER-MILLER WITH MACHINE TOOL MOUNT DOES THE WORK OF A SINGLE-PURPOSE MACHINE COSTING 100 TIMES AS MUCH!

Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¼ HP, speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing; rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

Write FOR CATALOG

PRECISE PRODUCTS CO., 1342 Clark St., Racine, Wis.

PRECISE GRINDER-MILLERS

For additional information Circle No. 70 on the Reader Service Card

continued from page 49

cycle at 6 volts and rinse.

5. Acid dip in a phosphoric acid type bath. (Phosphoric acid type bath has been found to yield fewer rejects than sulphuric.)

6. Rochelle copper strike, 5-10 seconds at 6 volts.

7. MacDermid bright copper to a thickness of .0003 in 15-20 minutes at 15-25 amps per square foot.

8. Cold rinse.

9. Dip in 5 percent sulphuric acid bath and cold rinse.

10. Rinse again and pass through nickel tank. (Udylite automatic plating tank with no reracking of castings.) Plate thickness is .0003-.0005, current density 25-40 amps psf, time of cycle 12 minutes.

11. Two water rinses.

12. Chromium plate for 2½ minutes to .00001 plate thickness.

13. Two cold and one hot water rinse.

14. Hot air dry.

15. Rack goes to conveyor for inspection and ready for assembly.

Note that steps 10-15 are all completely automatic, as part of the Udylite automatic plating installation.

Painting as an alternative finish. Somewhat simpler in application and lower in cost is the application of an organic finish. For some portion of the production of those ice crushers, a hard, baked white gloss enamel is applied.

This type of finish also requires a smooth surface on the casting, but this smoothness can often be achieved on a casting which has some flow marks or other defects. The presence of subsurface porosity which is a

continued on page 65

high corrosion resistance
paint base
bright finishes
final finishes
SPECS FOR NON-FERROUS FINISHING GOT YOU DOWN?
FIND OUT ABOUT IRIDITE TODAY for finishing ZINC, CADMIUM, ALUMINUM, CUPROUS METALS
WANT CORROSION RESISTANCE? Iridite will give you better-than-specification protection against corrosion.
WANT PAINT ADHERENCE? Iridite provides a firm and lasting base for paint by preventing under-film corrosion.
WANT EYE-APPEAL? Iridite can give you a variety of finishes, depending upon the metal being finished . . . from clear and sparkling bright or military olive drab, to attractive dyed colors.
BEST OF ALL, any Iridite finish is economical and easy to apply.
for example: IRIDITE (AL-COAT) REDUCES NEED FOR ANODIZING
Simple chemical dip; immersion time only 10 seconds to 2 minutes; no sealing dip; color is clear or yellow depending upon your requirements; salt spray resistance equivalent to 20 to 30 minutes of anodizing, eliminates need for costly racks and electrical power.
WANT TO KNOW MORE? Write for literature and send production samples for free test processing. See "Plating Supplies" in your classified telephone directory or write direct.
Iridite is approved under government specifications.
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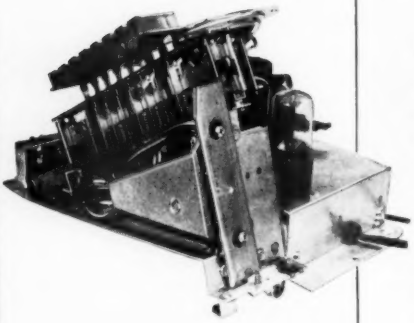
This man can show you . . .

How to pick up extra savings with *simpler* P-K assembly plus power driving



Portable electric drivers are used to speed assembly of this inter-office communication set, because mis-threading worries are eliminated. The 28 P-K Hex Head Type Z and Phillips Head Type Z Screws drive easily, set up securely, can be removed and replaced when necessary. Fastenings are made in 18 gauge CRS and aluminum die-casting.

Ask a P-K Assembly Engineer where you can take further advantage of power driving. Often, a switch to P-K Screws gives production a *double* lift. You save the time for needless tapping, bolting, riveting, or inserts in plastics. You also find that the *simpler* P-K method permits use of power driving to further speed assembly.

With the experience of more than a million applications to guide him, a P-K Assembly Engineer can quickly provide the answer to this, and other questions about making your assemblies better, faster, stronger, and at lower cost.

Today, more than ever, the P-K Assembly Engineer is a good man to have on your production team, helping you boost output and beat the squeeze on profits. He'll call at your request. Parker-Kalon Corporation, 200 Varick St., New York 14.

This Bulletin on Power Driving will help you determine which type is best for your work. Describes and illustrates the various basic types of electric, air-operated and impact tools, as well as the automatic hopper-fed machines for screw driving in common use. Also useful information on proper bit and socket selection. Free on request. Ask for Form 401.

Your INDUSTRIAL SUPPLY DISTRIBUTOR . . . *your local source for P-K Screws . . . works side by side with the P-K Assembly Engineer. Their combined efforts are solving many difficult problems of planning and procurement. Let them help you.*

P-K TRADE MARK REG. U.S. PAT. OFF.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

FOR EVERY METAL AND PLASTIC ASSEMBLY

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PMM USEFUL LITERATURE

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

PROCESSES

Ductile Parts by Powder Metallurgy: No. 144
Reprints of a paper presented before a meeting of the AIME discussing "Ductile Parts by Powder Metallurgy," are available from Kwikset Locks, Inc. Requirements for securing high ductility are reviewed, and nine examples of ductile parts produced by powder metallurgy are discussed.

Review of the Zinc Supply Situation: No. 145
The availability of special high grade zinc used for die casting alloys is discussed in the current issue of The Alloy Pot published by the New Jersey Zinc Co. Also included are six brief case histories of interesting die casting applications.

Die Casting Facilities in Mid-West: No. 146
The die casting facilities of Racine Die Casting Company are illustrated and described in a new folder from that company, showing also several pages of examples of zinc and aluminum die castings the company is producing. Special feature of the company's service is a fireproof vault for the safe storage of all tools and dies.

Metal Powder Machine Parts: No. 147
In a bulletin describing Wel-Met molded and sintered metal powder machine parts, 26 examples of such components are presented, together with a brief summary of the material used, the former method of fabricating, and the advantages of powder metallurgy.

Enlarged Die, Permanent Mold and Sand Casting Facilities: No. 148
Now marking its 25th anniversary, the Kiowa Corporation has just published a new booklet showing its facilities for producing die castings, permanent mold castings and sand castings. The company recently completed construction of additional plant capacity.

Design Data for Powder Metallurgy: No. 149
Six pages of design data for powder metallurgy are offered by American Sintered Alloys, Inc. A full page of recommended design procedure is included, along with considerable information on materials and properties.

Prealloyed Steel Powder: No. 150
Two bulletins from Vanadium-Alloys Steel Company contain reprints of technical articles on stainless steel powders. One deals with stainless steel powder for mechanical parts, the second is entitled "Mechanical Properties of Stainless Steel Powders".

Electrical Contacts & Contact Materials: No. 151
A review of electrical contacts and contact materials, including powdered metal compositions, is the subject of a new catalog offered by Gibson Electric Company. The 12-page publication has many specification charts, illustrations and tabulations of properties.

Pictorial Review of Shell Molding Process: No. 152
The issue of the "Dow Diamond" for April 1952 contains a pictorial 6-page article on the shell molding process, showing step-by-step operations.

Vacuum Die Casting: No. 153
The advantages, uses and properties of aluminum bronze vacuum die castings are all described in an eight page brochure recently issued by the Aurora Metal Co.

Super Dense Aluminum Die Castings: No. 154
The production of super-dense aluminum die castings is reported in Die Casting News for April-May, issued by Lester-Phoenix, Inc. The castings, being produced on a Lester HHP-3X-S machine, are end plates for an air brake assembly where absolute freedom from leakage and high strength are essential.

MATERIALS AND EQUIPMENT

Hot Work Steels: No. 156
A hot work die steel that is designed for all types of die casting dies is presented in a 6-page folder from Allegheny Ludlum Steel Corp. describing their Potomac M and other grades of hot work steel.

Waxes for Investment Patterns & Die Lubricants: No. 157
An interesting little booklet from General Wax Refining Co. outlines properties of many different waxes, including specific recommendations for waxes useful for investment casting patterns and also waxes for die casting die lubricants. Included are vegetable, animal, mineral, petroleum and synthetic waxes. Properties of various waxes are tabulated.

Recuperative Twin-Crucible Furnace: No. 158
A twin crucible melting furnace for aluminum, copper-base alloys and other non-ferrous metals is introduced in a 4-page bulletin from Morrison Industries, Inc. Special feature of the furnace is its use of waste gases from heating one crucible, to premelt metal in a second crucible, thus economizing on fuel.

Furnaces & Atmospheres for Sintering: No. 159
The several types of Globar-heated sintering furnaces manufactured by Lindberg Engineering Company, and the atmosphere generators which are produced by Lindberg, are shown and described in a new bulletin No. 230. Designed for sintering powder metal products, these units are both batch and continuous designs.

Properties of Metallic Hydride Powders: No. 160
A 16-page booklet from Metal Hydrides, Inc., gives detailed reports on the properties of metallic hydrides which are compounds of various elements with hydrogen. Produced as metal powders 300 mesh or finer, the hydrides of titanium, zirconium, thorium, tantalum and columbium are discussed. Alkaline earth hydrides are also reviewed.

Sintering Furnaces with Built-In Atmosphere Control: No. 161
The patented "Certain Curtain" feature of Hayes electric furnaces is illustrated and described in new catalog No. 112 from C. I. Hayes Inc., showing a line of furnaces for sintering, annealing, brazing, etc. The "Certain Curtain' is a built-in atmosphere control method which protects the work even when the door is open for loading or unloading.

Four Die Casting Die Lubricants: No. 162
Four die casting die lubricants developed expressly to provide clean, accurate castngs, longer die life and more economical production, are described in a new 4-page folder from E. F. Houghton & Co. Proper dilutions and applications are recommended.

continued next page

USEFUL LITERATURE (continued)

Curing Microporosity by Impregnation: **No. 163**
A method of sealing microporosity in ferrous or non-ferrous castings is described in a folder from Polyplastex International, Inc. Sealant is reported to be chemically resistant and able to withstand a wide temperature range. Does not affect critical tolerances or discolor surfaces.

Refractory Sintering Fixtures, Molds, Etc.: **No. 164**
Refractory fixtures, molds trays and special shapes for holding and positioning parts during sintering operations are presented in two one-page bulletins from Ceramic Division of Western Gold & Platinum Works. Almost complete freedom from cracking or spalling due to rapid temperature changes is one of several important features of the Wesgo Super Refractory material.

Electronic Powder Designations & Comparisons: **No. 165**
A tabulation of electronic powders, together with recommended frequency range, relative Q and relative permeability, is included in a data sheet from Magnetic Powders, Inc.

Design of Chain Belt Conveyor Furnaces: **No. 166**
Reprints of an article "Chain Belt Conveyor Furnaces—Their Design, Construction and Application," by W. F. Ross of The Electric Furnace Company, are available.

Three Models of Tablet Presses: **No. 167**
Two specification sheets from Arthur Colton Company illustrate and give complete data on three models of tablet presses, including one rotary press and two single & multiple punch presses.

Oxidation Resisting Metal Powders: **No. 168**
Special features of Resistax metal powders produced by an exclusive process are outlined in a folder from The Glidden Company. These oxidation resisting powders are reported to result in improved uniformity, reduced die wear, reduced material waste and improved finished part characteristics.

Pre-Setting Gages: **No. 169**
Scully-Jones pre-setting gages for setting tools used in multiple spindle machines are included in a new bulletin No. 19-50. Flush pin gages, height gages, and combination tool boards and benches are presented.

Electronic Core Material Data Sheet: **No. 170**
In a data sheet available from Radio Cores, Inc., is listed significant information concerning electronic cores. All data are tabulated in order of decreasing permeability.

Complete Air Valve Catalog: **No. 171**
A new 12-page catalog has been published by Rivett Lathe & Grinder, Inc., offering a complete file on 19 air valves produced by the company. Description, working drawings, size specification and cut-away views are included.

Obtaining Denser Die Castings: **No. 172**
A brochure introducing the new Wedgelock die casting machine for producing denser aluminum ,magnesium and brass die castings has been offered by Cuyahoga Industries. . Special feature of this machine is high pressure die locking to permit higher casting pressures.

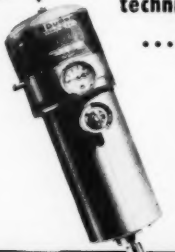
Lubricants for Powder Metallurgy: **No. 173**
"Cyanamid Metallic Stearates" is a new release from American Cyanamid Co. describing their metal stearate lubricants for use in the powder metallurgy and other industries. The new booklet gives information on purity and fatty acid control as well as suggested applications.

Materials for Investment Casting: **No. 174**
A file folder packed with information on PV investments is available from Pre-Vest, Inc. The folder, a standard 9x11½ for easy filing and reference, contains information about the uses, prices, and characteristics of this company's investment materials.

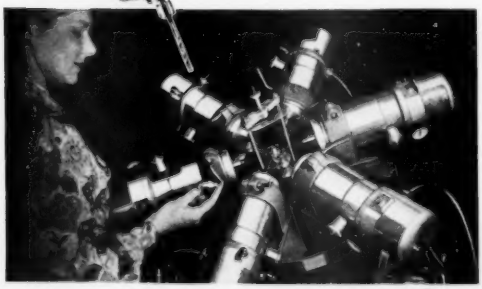
FINISHING

Barrel Finishing Techniques: **No. 176**
An informative book, "Barrel-Finishing with Alundum Tumbling Abrasive," contains practical information on barrell finishing techniques. Available from Norton Company.

Only **THE DUMORE®**
Automatic Drill Head offers the technique of Resistance Drilling ...eliminates drill breakage



THIS new Dumore tool virtually eliminates drill breakage on small-diameter, deep-hole drilling operations. Utilizing "Resistance drilling," workpiece determines drill feed and speed rate. Tool always maintains uniform pressure. Eliminates operator guesswork. Get all the facts. Ask your distributor, or write the Dumore Company.



Six Dumore Drill Heads slashed $75 from labor costs on the first run of 5273 bronze nozzle holders.

THE DUMORE COMPANY
1317 Seventeenth Street • Racine, Wisconsin

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Machine de-burring with NOBUR pays BIG production dividends!

NOBUR Tools *turn a slow bench operation into fast and efficient machine work!* **Remove burrs on multi-walled parts with a smooth, clean cutting action that won't mar highly finished surfaces. Eliminate rejects from slow, costly hand work with files, scrapers and abrasives.**

Nobur Tools are used on any lathe, drill press, portable drill or flexible shaft. Operation of the double-edge cutting blade is easy and safe . . . no skilled help is required, and the spindle *never needs to be stopped* **for either de-burring or chamfering.**

Nobur Tools cut freely on either hard or soft metals, are simple in construction and are made in sizes to cover a full range of hole diameters. *NEW "DS" SERIES extends range of NOBUR applications to holes as small as ⅛" diameter. WRITE FOR FULL DETAILS TODAY!

Parts like these quickly de burred with

NO/BUR TOOLS

NOBUR MANUFACTURING COMPANY
719 N. VICTORY BLVD., BURBANK, CALIF.

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Performing Reciprocating & Rotary Cutting: No. 177
A compact machine capable of a sequence of reciprocating and rotary cutting operations, particularly those connected with complicated shapes and angles, is the subject of a brochure from Multiversal Machine Company. Among the many operations performed by the Multiversal are included milling, jig boring, slotting, filing, drilling, grinding, broaching, and die sinking.

Grinding Clutch Facings & Brake Linings: No. 178
The photographic story of grindnig clutch facings and brake linings at U. S. Asbestos Div. in Manheim, Pa., is contained in the April 1952 issue of "The Gardner Grinder" published by Gardner Machine Co. Also included is a page on the grinding of non-metallic materials.

Handbook of Finishing with Coated Abrasives: No. 179
A compact 88-page handbook from The Carborundum Company shows more than 20 separate categories in its table of contents, and has a specification section listing all makes of belt sanding machines and the abrasive belt requirements for each. It also included directions and diagrams of making belt splices.

Engineering Data on Thread Cutting Screws: No. 180
In 4 pages of specifications, Reliance Div. of Eaton Mfg Co. shows its line of preassembled thread cutting and self tapping Springtites & Sems. Specific types for steels, die castings, and plastics are recommended.

Marking Machines: No. 181
A brochure from Jas. H. Matthews & Co. introduces a line of general purpose marking machines ranging from hand operated models to the heavy duty, fully automatic pneumatic operated ones.

Review of Metal Cleaners: No. 182
Summary of their line of metal cleaners is offered in a new 6-page bulletin from E. F. Houghton, reporting on alkaline, emulsion acid phosphate and surface active agent types of cleaners.

Drawings Emphasize Economy in Polishing: No. 183
Using a cartoon and simplified drawing technique, Behr-Manning Corp. has issued an illustrated instructive booklet describing the advantages of coated abrasive belt polishing methods. Title of the booklet is "How Polisher Pete Put Economy in Polishing."

Vapor Degreasing Equipment and Supplies: No. 184
For faster, more efficient degreasing of all types of parts and materials the Phillips Mfg. Co. offers a complete line of equipment and supplies. A new catalog is now ready for distribution.

SURFACE PROPERTIES OF FINE PARTICLES

"Research on Surface Properties of Fine Particles," a report prepared for the Army Signal Corps by Georgia Institute of Technology, describes a new "fatty acid absorption" technique for surface area measurement of fine particles. Of particlar use to the metallurgical, ceramic and chemical industries, the new process greatly shortens the time required for such measurement. Copies can be ordered, under identification PB 104 372 (title above) from Office of Technical Service, Department of Commerce, $10.00 photostat, $3.50 microfilm.

WAGNER BROS. EXPANDS

J. R. Wagner, president, Wagner Brothers, Inc., Detroit, Michigan has announced the completion of the new wing which will house additional anode production facilities. This is a continuation of a plant expansion program which began in 1948. Built of structural steel and cinder block the building is now ready for production.

NEW CARBOLOY MANAGER

Jos. C. Morrison has been named manager of the Carboloy plant at Edmore, Mich., according to an announcement from K. R. Beardslee, general manager of the Carboloy Dept., General Electric Co.

50 Years and Still Tops **GLOBE**
direct motor drive

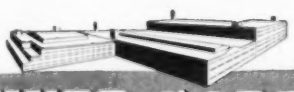
Available in Kiln-Dried Maple or Steel Shells

FINER FINISHES AT LOWEST COST. Today Globe Tumbling Barrels assure you increased production and finer, more economical finishes. Globe's exclusive work-shifting bottom gives six-way motion for greatest parts agitation to save finishing time and to give uniformly finer finishes to your parts. Low speeds for non-ferrous metals and plastics assure quality finishes with less spoilage.

Globe's direct motor drive is a space-saver for your shop, and its compact, rugged construction means years of dependable service.

FREE EXPERIMENTAL SERVICE

Like to cut finishing costs? Hupp's experimental laboratory will analyze your product finishing needs and make cost-saving recommendations. Send samples of your parts to be processed and a finished part. No charge or obligation. Write today!



Hupp Manufactures A Complete Line Of
Tumbling Barrels and Deburring Machines

HUPP CORPORATION
GLOBE STAMPING DIVISION
1250 WEST 76th STREET • CLEVELAND 2, OHIO
SERVING INDUSTRY SINCE 1902

For additional information Circle No. 48 on the Reader Service Card

DIES Last Longer when you CLEAN 'EM with Pangborn HYDRO-FINISH®

MOLD and die tolerances are held to .0001" when you clean and finish them with Pangborn Hydro-Finish. Fine-mesh abrasives suspended in water do a precision job . . . there's no danger of excessive metal removal . . . no danger of expensive equipment being ruined!

What's more, Hydro-Finish saves you more money because it saves time and labor! Operated by one man, a Pangborn Hydro-Finish machine removes scale and discoloration in *minutes* instead of hours. And, cleaned surfaces are virtually free of directional grinding lines, eliminating or reducing further finishing operations.

GET THE FACTS on Hydro-Finish and how it can help prolong the life of dies and save you money! Write today for Bulletin 1400-A. Address: PANGBORN CORP., 3500 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment.

Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

Circle No. 62 on the Reader Service Card

PROMOTIONS AND APPOINTMENTS

Four promotions by *The Diversey Corp.* include: DONALD V. HANNIBAL to become director of Technical Development Department; B. B. BUTTON to become general sales manager; R. J. KELLER to become credit manager; C. R. REID to become assistant to the vice president in charge of sales.

Promotions and new appointments at *Wellman Bronze & Aluminum Co.* of Cleveland include: JAMES M. ROBERTSON as chief chemist in charge of quality control at all plants; ROBERT C. BOEHM as chief metallurgist; ROBERT W. SPACEK as assistant production manager for all plants.

ALLAN RAY PUTNAM as assistant executive secretary of the *American Society of Tool Engineers.*

James M. Robertson
Wellman Bronze

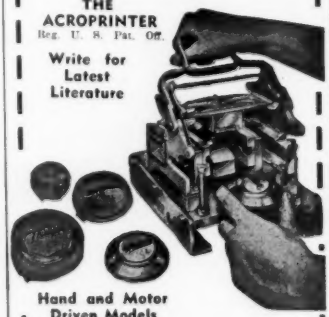
Two promotions by *United Chromium, Inc.*, are: WALTER S. CIBULSKIS as chief of engineering and FREDERICK G. BAUER as manager of engineering.

RICHARD V. D. STRONG as

ACROMARK
MEANS "ACCURATE MARKING"

ENAMEL FILL YOUR DIE-CAST PARTS with THE ACROPRINTER
Reg. U. S. Pat. Off.

Write for Latest Literature



Hand and Motor Driven Models

The ACROMARK Company

426 Morrell St., Elizabeth 4, N. J.
"The Original Marking Specialists"

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FREE!

61 PAGES OF FACTS FIGURES PHOTOS ON **BARREL FINISHING**

Get the complete story! Learn about latest developments in equipment, compounds, abrasives. Amazing results now possible on almost all types of parts from large castings to small intricate parts.

Write Today For 3 FREE Booklets

D-7

ALMCO **Supersheen**

AMERICA'S LARGEST MFGR. OF ADVANCED BARREL FINISHING EQUIPMENT, MATERIALS & COMPOUNDS
ALBERT LEA, MINNESOTA

Circle No. 77 on the Reader Service Card

chief engineer of the *F. J. Stokes Machine Co.* of Philadelphia.

New sales managers for district offices of *Tinnerman Products, Inc.*, are: CHRIS RINGHAVER, Chicago; HERMAN H. WELLAND, Cincinnati, Ohio; THOMAS M. LANDFEAR, Rochester, N. Y.

Appointments at the new Edmore, Mich., carbide tool plant of *Carboloy Dept., General Electric Co., include* STEVEN J. WILCOX, general foreman; ROBERT J. MARCUS, manager employee & plant community relations; and CHARLES MOX, ADOLPH WEGNER and JOHN HARBROOK, supervisors.

MATT W. STANLEY as assistant treasurer of *Aluminum Company of America.*

JOHN J. CLEMENS of Houston, Texas has joined the magnesium sales group in the Houston office of *The Dow Chemical Co.* and RICHARD K. MORSE has joined the company's St. Louis office.

For additional information Circle No. 49 on the Reader Service Card

ALL DIE CASTING PROBLEMS CAN BE SOLVED —
THE Authenticast WAY
DIE CASTING
• ZINC ALLOYS
• LEAD ALLOYS
COMPLETE ASSEMBLED PRODUCT OR ANY SPECIFIC PART!
Send Blueprints or Specifications—
ESTIMATES GIVEN WITHOUT OBLIGATION
COMET METAL PRODUCTS CO., INC.
91-07 132nd St. Richmond Hill, N. Y.

Circle No. 71 on the Reader Service Card

CUTS SCRAP LOSS 25%

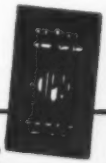
BRASS POWDERED METAL ARMING SLIDER FOR AMMUNITION FUZE

molded by IPM replaces a screw machined product with a 25% saving in scrap loss. In addition, the job was tooled and in production in less time—machining and finishing operations were eliminated — all-over production costs were lowered.

Greater uniformity in weight, size and surface finish of illustrated parts insured consistent arming of fuze mechanism.

Whatever your component requirements—defense or civilian—it will pay you to check with IPM.

The Powder Metallurgy Engineers Handbook is available to you. Send for a copy on your company's letterhead.



IPM
International Powder Metallurgy Co.
439 W. MAIN STREET • RIDGWAY, PENNSYLVANIA

For additional information Circle No. 55 on the Reader Service Card

OPPORTUNITIES

CHIEF ENGINEER
Salary $8000 - $10,000

Permanent mold and die cast die design experience in light metals required. Man we want has a sound record behind him and has top management ambitions for the future. Bonus plan. Write in detail. Box No. 7152, Precision Metal Molding Magazine.

FOUNDRY SUPERINTENDENT

Thoroughly experienced man in aluminum permanent mold for modern midwest foundry. Magnesium experience helpful. Essentials are ability to handle people and maintain production schedules. Technical background helpful, not required. For a qualified man who probably has at least 10 years experience, salary is open and future unlimited. Bonus plan. Send complete resume in confidence. Box No. 7252, Precision Metal Molding Magazine.

WANTED:
We would like to buy a medium or small die casting company in a good location. Your inquiry will be handled in strictest confidence. Reply to Box No. 7352, Precision Metal Molding Magazine.

PRECISION INVESTMENT CASTING SUPERVISOR. 10 years experience, ferrous & non-ferrous metals. Production & quality control. Reply to Box No. 7452, Precision Metal Molding Magazine.

DIE CASTING ACCOUNT WANTED
State of Indiana

Indiana's leading manufacturers' agency, experienced in die casting sales and service, wishes to become associated with reputable firm manufacturing precision aluminum and zinc die castings.
Our sales organizaton is well known and respected in the purchasing departments of Indiana's leading industries. Reply to Box No. 7552, Precision Metal Molding Magazine.

'sure I've solved my Metal Powder Lubrication Problem with CYANAMID ZINC STEARATE"

Cyanamid Zinc Stearate's *extremely small particle size, high covering power* and *great bulk* can provide the answer to *your* lubricating problems – can speed up your processes and improve the quality of your moldings.

For a sample of Cyanamid Zinc Stearate and an informative bulletin, "Cyanamid Zinc Stearate as a Lubricant in Powder Metallurgy," mail the coupon below.

AMERICAN Cyanamid COMPANY
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American Cyanamid Company
Industrial Chemicals Division, Dept. PM 7
30 Rockefeller Plaza
New York 20, N. Y.

Please send me a sample of Cyanamid Zinc Stearate and a copy of your bulletin on Zinc Stearate as a Lubricant in Powder Metallurgy.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

In Canada: North American Cyanamid Limited, Toronto and Montreal

For additional information Circle No. 33 on the Reader Service Card

EXPAND FACILITIES FOR CARBIDE PRODUCTION

Metal carbides Corporation, Youngstown, Ohio, announces that it will commence construction in the near future of a $1,000,000 plant on a 17-acre site located at Mathews Road and Southern Blvd., Boardman, Ohio, a suburb of Youngstown. The new facility will have a monthly capacity of approximately 25,000 lbs. of tungsten carbide metal, tungsten alloy heavy-metal, titanium metal and other special alloys made from powdered metals. Certificates of Necessity have been granted the company by the Defense Production Administration to construct the above facility.

The main plant of the company at 107 East Indianola Avenue will be continued in operation, producing a full line of tungsten carbide cutting tools, drawing dies, rolling mill rolls, diamond products and machine tool attachments. The productive facilities of this plant have been more than doubled during the past two years with another 10,000 sq. ft. of floor space having been recently added, making total factory space at the present plant over 50,000 sq. ft.

PMM INDUSTRY NEWS

NEW APEX PLANT TO PRODUCE ALUMINUM-SILICON METAL FROM CLAY

Apex Smelting Co. announces that it is constructing a commercial pilot plant in the Pacific Northwest. Using clays as a raw material, this plant will produce intermediate alloys containing aluminum and silicon.

This is a further step in a development started five years ago when Apex began to investigate the direct reduction of clays which contain these metals. Through the cooperation of the Tennessee Valley Authority and the Bureau of Mines, Apex was able to develop further details of this process. The alloys produced in these experiments were exhaustively tested in Apex's laboratories and in its customers' products with successful results.

The alloys produced by this direct reduction process will be used by the company in its products and also will be available to other metal users. It is contemplated that production will be expanded as soon as optimum design is proven in its pilot operation.

REPRESENTS PRECISION METALSMITHS IN N. Y. AREA

Precision Metalsmiths, Inc., of Cleveland, Ohio, have announced the appointment of Albert Dormaier, Jr., as the firm's direct sales engineer in a territory composed of northern New Jersey, metropolitan New York and Long Island. Mr. Dormaier is a resident of Nutley, N. J., and has been identified in sales capacities with Jabel Ring Mfg. Co., Belleville Motors, and Wefferling, Berry & Co.

Albert Dormaier, Jr.

USE 226,000 TONS OF ZINC FOR DIE CASTINGS

Consumption of zinc by the die casting industry during 1951 is estimated at 226,000 tons, according to the American Die Casting Institute, Inc. This compares with 281,385 tons consumed by the industry in the preceding year.

OFFICERS RE-ELECTED

F. C. Boyce of Wauwatosa has been re-elected president of the D. J. Murray Manufacturing Co., of Wausau, Wisconsin, for the 20th consecutive time.

Other officers re-elected are M. P. McCullough of Chicago and D. C. Everest of Wausau, vice-presidents; A. W. Plier of Wausau, executive vice-president and general manager; G. L. Ruder of Wausau, treasurer; W. A. Marquardt of Wausau, secretary; and C. L. Durkee of Wausau, vice-president and sales manager.

J. HOLLAND & SONS PLANT EXPANSION

J. Holland & Sons, Inc., manufacturers and distributors of metal finishing equipment, Brooklyn, N. Y., announce the expanding of plant facilities in a new three floor steel and reinforced concrete fireproof building at 45 Johnson Ave. in the heart of industrial Brooklyn. The new plant will be a short distance from their present address at 276 South 9th St., Brooklyn, New York. The new building will be ready for occupancy within a few months.

ALLOY PRECISION NAMES SALES HEAD

Appointment of S. E. Flenner, Jr. as general sales manager of Alloy Precision Castings Co., Cleveland, is announced by S. J. Sindeband, president.

Mr. Flenner will be in charge of the company's national sales program aimed at expanding markets for Mercast process frozen mercury type "investment" castings. A metallurgical engineering graduate of Penn State, Mr. Flenner was formerly affiliated with the Methods Engineering Council, Pittsburgh, management consultants. His experience also includes service

S. E. Flenner, Jr.

as sales promotion administrator of Koppers Company, Pittsburgh. During World War II, he served in the U.S. Army Air Corps.

VASCOLOY-RAMET STARTS EXPANSION

Ground was broken May 23 at Waukegan, Illinois for a large new building which begins a major expansion and improvement program which will increase productive capacity by 50 percent for Vascoloy-Ramet Corporation.

When the program is completed late in 1952, the Vascoloy-Ramet plant will have completely modern facilities for the production of carbide cutting tools, blanks and wear-resisting parts, wire and tube drawing dies, mining and rock tools, Tantung (cast alloy) cutting tools and custom-made intricate castings.

The present Vascoloy-Ramet plant is being remodeled so that it and the new facilities will be integrated. Existing equipment is being rearranged and new facilities will be integrated. Existing equipment is being rearranged and new equipment added so that production will flow smoothly in straight lines.

BREAKING GROUND

Ground was broken May 23 to start an addition to the Vascoloy-Ramet Corporation plant at Waukegan, Illinois. Left to right: George Swanson, general contractor; Herbert B. Clark, president of Vascoloy-Ramet Corporation; A. Epstein, engineer; Robert J. Aitchison, president of Fansteel Metallurgical Corporation; Dr. Frank H. Driggs, Fansteel executive vice-president; Sidney Epstein, engineer.

REED-PRENTICE MOVES

The Chicago branch sales office of Reed-Prentice Corp., Worcester, Mass., moved into new quarters at 4001 N. Elston Ave., Chicago 18, Ill. on July 1.

HOWARD FOUNDRY BUYS INVESTMENT CASTING UNIT

The Howard Foundry Company of Chicago, Ill., purchased the investment casting division of Allis-Chalmers Mfg. Co. on April 14 and will continue to operate in the present plant located at 1347 South 65th St., Milwaukee, Wisc.

The change was made with no halt in production. All key personnel formerly associated with this division of Allis-Chalmers

AS THE NAME INDICATES

Paragon

Aluminum and Zinc Base

DIE CASTINGS

Are Superior in . . .

FUNCTION

APPEARANCE

DESIGN

and STRUCTURE

Consult any of the offices listed below or write us directly.

PARAGON Die Casting Company

5853 WEST DICKENS AVE. • CHICAGO 39, ILL.

SALES OFFICES: DETROIT • INDIANAPOLIS • CHICAGO • MILWAUKEE

For additional information Circle No. 42 on the Reader Service Card

are now continuing with Howard Foundry. Plans are now being made to expand this operation as soon as permanent headquarters and facilities can be obtained.

KUHLMAN ELECTRIC GETS SOUTHERN DIVISION

Kuhlman Electric Company, Bay City, Mich., has announced the purchase of the assets of the Queensboro Transformer and Machinery Co. in Crystal Springs, Miss., and the lease of the transformer manufacturing plant under construction at Crystal Springs. The new plant which will be completed in the near future, will facilitate distribution of the company's products in the southern area of United States. In addition to its line of transformers, controls and line regulators, Kuhlman Electric also manufacturers metal melting furnaces through its subsidiary, Detroit Electric Furnace Co.

For additional information Circle No. 54 on the Reader Service Card

Better CASTINGS

(NON-FERROUS)

SAND CASTINGS
PERMANENT MOLD
DIE CASTINGS

Hampden Brass & Aluminum Co. is fully equipped to handle all casting problems — from engineering to finished casting.

PATTERN SHOP • X-RAY & LABORATORY FACILITIES

PRESSURE CASTINGS • HEAT TREATING

HB

HAMPDEN BRASS & ALUMINUM CO.
INCORPORATED 1903
SPRINGFIELD 1, MASSACHUSETTS

Our Customers Say:

"We have found

HENNING to be our

best source of supply for

ZAMAK die casting alloys!"
(ZINC BASE)

Return the coupon below to be put on the mailing list to receive our monthly house organ and booklet covering all zinc base alloys.

A trial will convince you, too. Remember the name—HENNING. It means absolute satisfaction.

HENNING BROS. & SMITH INC.
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HB&S HB&S HB&S HB&S

We would like to receive "THE HENNING MESSENGER" AND DESCRIPTIVE BOOKLET.

Name .....

Address .....

City ..... State .....

For additional information Circle No. 39 on the Reader Service Card

REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

1. INDUCTION MELTING furnaces for ferrous or non-ferrous metals is covered in data from Ajax Engineering Co.

6. SMALL DIE CASTINGS produced by Dollin Corp. small castings department, are the subject of a booklet.

9. FULL LINE OF DIE CASTING machines is presented in a catalog from Kux Machine Co.

10. DIE CASTING MACHINES built by Lester-Phoenix are described & illustrated in a catalog.

11. HYDRAULIC OIL FILTERS produced by Marvel Engineering are presented in a data sheet.

13. HOW TO CUT FINISHING costs on die castings is one of 2 new booklets offered by Monarch Aluminum. The other is "Good News for Design & Product Engineers."

16. MELTING EQUIPMENT: ladles, ingot molds, kettles, pots, etc. are included in a catalog from C. H. Milles.

19. DIE CASTING FACILITIES of Pressure Castings, Inc. are offered in a descriptive folder.

20. NEW DIE CASTING PROCESS for producing aluminum & magnesium castings faster is introduced in a bulletin from Reed-Prentice.

22. TILTING FURNACES for aluminum and magnesium are the subject of a bulletin from Stroman Furnace.

23. ALUMINUM ALLOY SELECTOR to aid in analysis of foundry problems is offered by U. S. Reduction.

24. TWO NEW ACCESSORIES for use with abrasive belts, are described in literature from Carborundum Co.

25. HELP IN SELECTING the best power screw driver for a specific job is contained in a bulletin from Parker-Kalon.

26. PLASTER MOLD CASTINGS by Atlantic Casting & Engineering Co. are described in "Quality Precision Castings."

29. DIMENSIONING DIE CASTINGS is the subject of a guide book from Newton-New Haven Co.

31. IRIDITE FOR PROTECTING metal surfaces is described in literature from Allied Research Products.

33. LUBRICANTS FOR POWDER metallurgy are described in literature on zinc stearate issued by American Cyanamid.

35. METAL - OF - THE - MONTH is a monthly resume of metal market news and data from Belmont Smelting & Refining Co.

37. SPECS FOR CAST-MASTER die casting machines are presented in a catalog from Cast-Master, Inc.

39. ZINC ALLOY SUPPLIERS, Henning Bros. & Smith, offer a monthly house organ called The Henning Messenger.

40. HOW TO DESIGN ALUMINUM and magnesium die castings is the subject of a data book from Litemetal Dicast.

44. PREVENTING METAL DRIP between faces of die casting dies with a new "No Drip" device is explained in literature from Ring Valve.

49. DIE CASTING FOR DEFENSE is the subject of a booklet, "We're Geared for Your Defense Needs" from Advance Tool & Die Casting.

53. SMALL DIE CASTINGS—review of size, alloy & design limits in a folder from Gries Reproducer.

55. DESIGNING FOR POWDER metallurgy is the subject of an engineer's handbook from International Powder Metallurgy.

60. ANALYSIS OF ALUMINUM, brass & bronze alloy specs is covered in new 36-page book from Sonken-Galamba.

62. LIQUID ABRASIVE BLAST finish techniques are described and blast equipment illustrated in a booklet from Pangborn Corp.

64. INVESTMENT MATERIALS to produce accurate, fine-surfaced castings are presented in a folder from Pre-Vest.

68. MACHINE DEBURRING of castings with a special type tool is introduced in literature from NoBur Mfg.

69. TIPS ON WASHING METAL are contained in a booklet, "8 Things to Look for When You Wash Metal by Machine," issued by Oakite Products.

70. MULTI-PURPOSE GRINDER-MILLER unit for diverse tool room & production jobs is the subject of a catalog released by Precise Products.

76. FILLING ENAMEL in recessed designs or lettering is described in literature from Acromark.

77. BARREL FINISHING is discussed in 3 booklets from Almco Div., Queen Stove Works, covering the process, materials & equipment.

SURFACE PROPERTIES OF FINE PARTICLES

"Research on Surface Properties of Fine Particles," a report prepared for the Army Signal Corps by Georgia Institute of Technology, describes a new "fatty acid absorption" technique for surface area measurement of fine particles. Of particular use to the metallurgical, ceramic and chemical industries, the new process greatly shortens the time required for such measurement. Copies can be ordered, under identification PB 104 372 (title above) from Office of Technical Service, Department of Commerce, $10.00 photostat, $3.50 microfilm.

PLATED OR PAINTED

continued from page 53

cause of blistering and poor adhesion in plating, is not as deleterious to a painted coating and such defects can often be polished out successfully

However, gloss enamel requires only one minor degree less of a perfect surface than is needed for plating. Since neither wrinkle paint nor the so-called novelty finishes are acceptable for kitchen appliances, the paint must have a smooth, solid metal base.

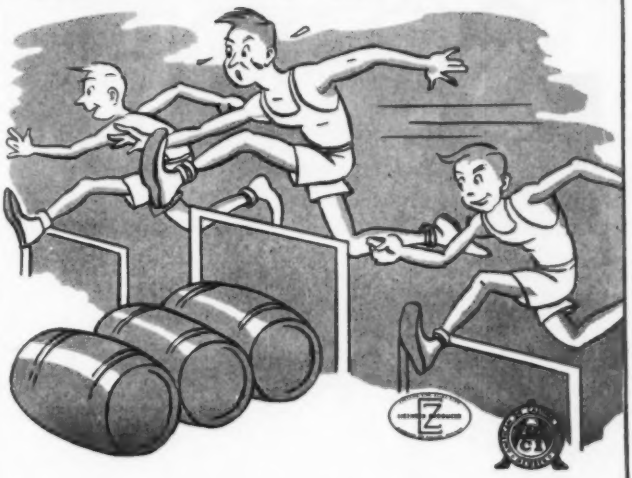
Painting cycle. The painting cycle is as follows:

1. Remove parting line flash with 120 abrasive belt.
2. Dip in mild alkaline cleaner.
3. Warm rinse.
4. Dip in oxalic acid to neutralize any alkaline solution retained in recesses prior to phosphate treatment. Cold water rinse.
5. Phosphate dip tank for 5 minutes at 160-170F.
6. Cold water rinse.
7. Dip in dilute chromic acid and follow with hot water rinse.
8. Dry before painting.
9. Prebake before enamelling to avoid blistering. This removes any retained chemicals or impurities left from previous steps in the cycle. It is especially desirable for processing before applying light enamels.
10. Spray enamel manually with high gloss white enamel.
11. Bake in infra-red oven at 300-400F for 7-10 minutes. Ice crusher bodies are painted with cover assembled.

Between the phosphate dip treatment and the painting, the castings are given a brushing to remove excess crystal growth which sometimes occurs.

Large volume of die cast parts. The ice crusher processing described above is only one of the many die cast components used by Dazey in its complete line of utilitarian kitchen devices. The process cycle may be said to be representative of the general approach to the finish of die castings by this company in attaining a high degree of excellence with regard to finish quality.

PUTTING YOUR BUSINESS OVER UNNECESSARY HURDLES...?



There are hurdles aplenty in every business. But it's up to management to keep those hurdles as low as possible.

A mighty good way to do it is to put the advantages of Badger Die castings to work for you. Let our design engineers show you how to enjoy the manufacturing economies and operating efficiency of quality die castings.

DIE CASTING CORP.
201 WEST OKLAHOMA AVE. MILWAUKEE 7, WISCONSIN

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For additional information Circle No. 39 on the Reader Service Card

WHETHER YOUR REQUIREMENTS ARE FOR

CASTINGS THAT ARE BIG
or
CASTINGS THAT ARE SMALL

There is no better source of supply in the Midwest than

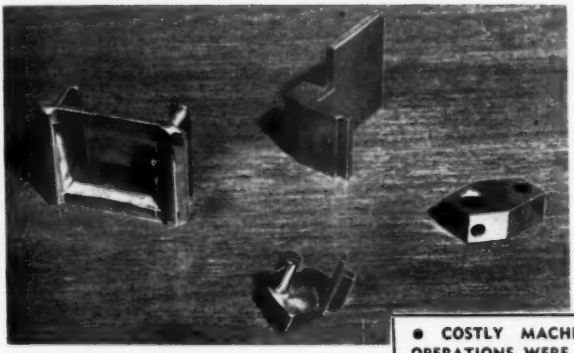
STROH

DIE MOULDED CASTING CO.
525 E. MICHIGAN ST., MILWAUKEE 2, WIS.
Since 1903

ALUMINUM PLATING PROCESS
continued from page 42

The aluminum plating bath is prepared at NBS by adding either lithium hydride or lithium aluminum hydride to an ethyl ether solution of anhydrous aluminum chloride. For best results, the ether should be anhydrous and alcohol-free. The concentration of the aluminum chloride is not critical and may vary from 1 to 4 molar. Current densities may be as high as 4 or 5 amperes per square decimeter. However, if thick deposits are desired, the current density should not be greater than 2 amp/dm^2. Because of the high concentration of aluminum chloride in the ether, the bath is not as flammable as would normally be expected.

To prevent the entrance of moisture, the bath is prepared



Scale: 2 to 1

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and used in a closed container consisting of a glass plating vessel with a tightly fixed polyethylene lid. Anodes of aluminum rod pass through the lid, and the objects to be plated (cathodes) are introduced and removed through a central hole which is ordinarily kept closed with a rubber stopper. If hermetically sealed, the bath will keep for several weeks; however, under ordinary operating conditions the solution slowly deteriorates and eventually gives streaked and brittle deposits.

No agitation of the bath is necessary. In fact, a quiescent bath is actually an advantage as the sediment from the anodes settles to the bottom of the vessel, making bagging of the anodes and filtration of the solution unnecessary. The composition of the bath is easily controlled since the only constituent that changes appreciably in concentration during the plating process is the lithium hydride. Occasional additions of lithium hydride increase the life of the bath, but in time the lithium hydride becomes insoluable and the bath can no longer be used.

When sufficient lithium hydride is used, the deposits are white, mat and quite ductile; but if the lithium hydride content is too low (less than 3 or 4 g/1,) the deposits become hard, brittle, and grey. Still further reduction of the hydride content produces deposits that are dark and stressed and that often crack or peel from the cathode. Ordinarily deposits 0.01 inch or more thick are visibly crystalline, but this effect can be reduced somewhat by adding a small amount of B,B'-dichloroethyl ether. Pitting, which frequently occurs in aqueous baths, is practically nonexistent in the ether bath.

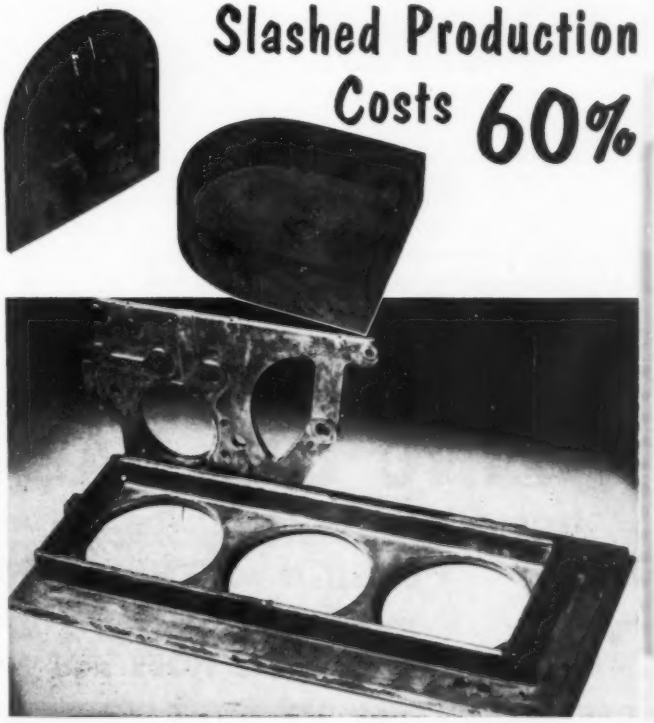
Cathode and anode efficiencies for the process are approximately 100 percent. Deposits 0.05 inch thick have been prepared at the Bureau, and thicker deposits should be possible if the sharp edges of the cathode are shielded to prevent treeing.

[1]For further details, see A hydride Bath for the Electrodeposition of Aluminum, by Dwight E. Couch and Abner Brenner, J. Electrochem. Soc. 99, 234 (June 1952)

STAINLESS STEEL POWDERS
continued from page 26

properties. Many other grades of stainless steel and high temperature alloys have been produced for specific research and development programs. This article, however, will be confined to a summary description of the properties of the five standard powders and parts made therefrom.

The powders listed in Table 1 are identified by their closest AISI stainless steel number. Type 302B is a standard 18% chromium 8% nickel grade; type 316 contains 18% chro-



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mium, 11% nickel, and 2% molybdenum; type 318 is similar to type 316 with the addition of 1% columbium, and type 431 is a 16% chromium, 2% nickel grade. All of these grades, identified as moldable powder, carry from 2-3% silicon, with the exception of 318. This chromium-nickel-molybdenum-columbium grade is available in moldable form with both 1% and 2.5% silicon contents.

Early attempts to make 18-8 stainless steel powder by the disintegration method did not produce usable material for pressing and sintering because of a preponderance of spherical particles with relatively high surface oxide content. It was learned that silicon additions to iron alloys, powdered by this process, gave bright powder of low oxide content and such additions were made to 18-8 stainless with similar results. An

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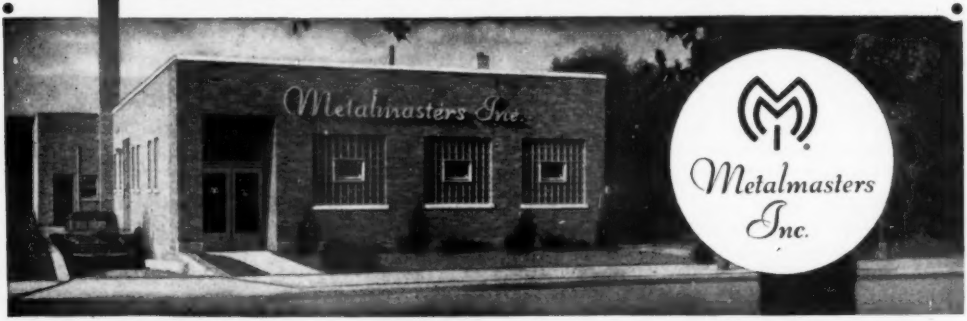

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attendant change in particle shape occurred, reducing the number of spheroids materially. Only in the type 318 has it been possible to produce a moldable powder with less than 1% silicon and the two resulting grades of this type are termed "318" and "318 Si."

The particle shape of the typical moldable or irregular powder is shown in Figure 5. All moldable powders have particle shapes similar to this and have similar apparent density values, as shown in Table 2. Spherical type stainless steel powders are also available for special applications in practically all grades. These spherical powders have higher apparent densities (3.1-3.9 grams per c.c.) and slightly higher oxide contents. While suitable for the production of filters and other parts by "loose-powder" or "dead-weight" sin-

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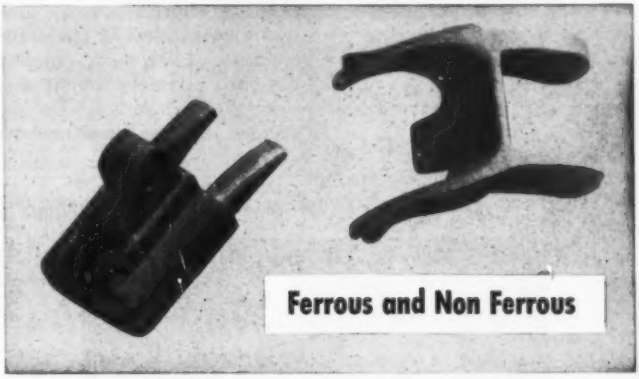

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tering, their higher initial oxide content, and poorer moldability resulting from the particle shape renders them less suitable for mechanical parts. In fact, a number of investigations have shown that while spherical particles are commonly preferred for porous bodies, controlled and reproducible porosity can be obtained using irregular powder (3).

Basic properties of the five stainless steel powders are show in Table 2. These properties represent the average values obtained from production lots of powder with the exception of type 318, which is a single heat result. Regardless of grade, the moldable —100 mesh powders have an extremely similar particle size distribution. On the average there are equal amounts by weight of powder in the mesh ranges:

—100 +140
—140 +200
—200 +325
—325

The compression ratio data, calculated as the ratio of the green to the apparent density are listed for each powder at 30, 40, and 50 t.s.i. compacting pressure, using specimens ½ inch in diameter, weighing 12 grams. The apparent density was determined using the Hall flowmeter with a 25 c.c. cup. Flow rate or time was determined in accordance with Metal Powder Association Standard 3-45. Oxide content is determined by measuring the weight loss in deoxidized, dried hydrogen after holding green pressed compacts ½ inch diameter by 12 grams for 45 minutes at *2300* F.

This temperature, higher than normal for testing metal powders, is felt necessary for a proper evaluation of surface conditions, since any chromium oxides present are not reduced at normal test temperatures. The weight losses shown compare favorably with previously reported stainless steel powders made by other methods. Spherical powders have higher weight losses—from 0.5-0.8 percent.

References

1.) G. A. Roberts and A. H. Grobe: "Prealloyed Steel Powders," The Iron Age, March 31, 1949.

2.) "Clean, Speedy, Accurate Melting Helps Make Prealloyed Steel Powder," Electrified Industry, August 1949, p. 28.

3.) F. V. Lenel and O. W. Reen: "Permeability and Strength of Porous Stainless Steel Compacts," Symposium on Testing Metal Powders and Products, A.S.T.M., March 1952.

Editor's Note: The second and concluding part of this article will appear in the August issue of PMM.

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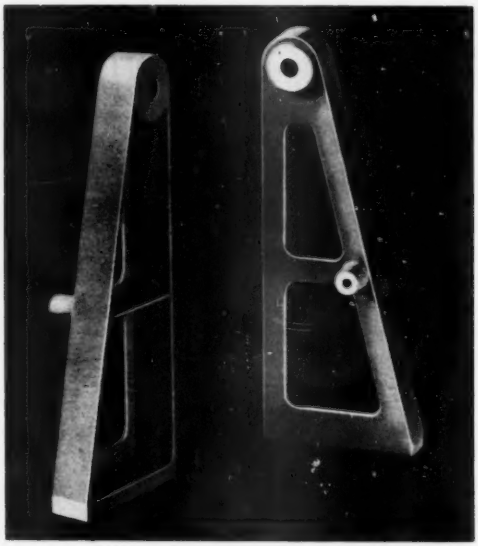

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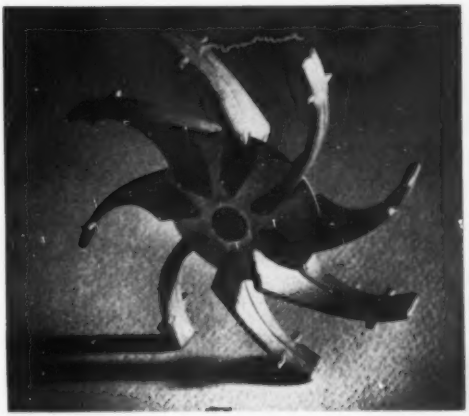
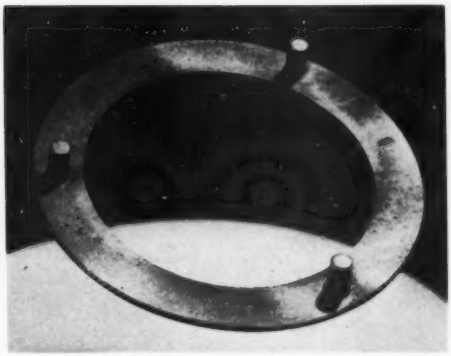
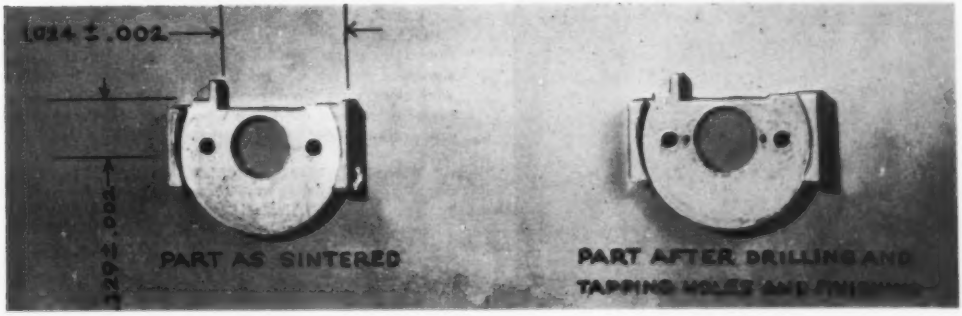




YELLOW BRASS CAN BE DIE CAST, thus opening up many uses for the die casting process where higher physicals are needed than can be attained with the more conventional zinc, aluminum and magnesium alloys. A good example is the impeller, above, die cast in brass by Pressco Casting & Mfg. Corp. of Chesterton, Ind. This piece, in yellow brass, has tensile strength of 60,000 psi and yield strength of 30,000 psi. Its 12 percent elongation makes possible the use of small cast bosses as a means of assembling stamped covers on the top and bottom surfaces of the impeller. The covers are placed over the bosses which are then riveted over to make a strong, permanent assembly. Balance of the impeller is close enough as cast.

SAVING OF 57 PERCENT has been brought about by producing this dial plate support by powder metallurgy rather than machining it from aluminum bar stock. The Joseph Dixon Crucible Co. of Jersey City, N. J., fabricates this part for Eclipse-Pioneer Div. of Bendix Aviation Corp. using a nickel silver powder with an analysis of 64 percent copper, 18 per cent nickel and 18 percent zinc. It eliminates 12 machining operations, permits faster deliveries, and gives parts to very close tolerances. Some of the tolerances on these dial support plates are: ±.002 on diam. of cored center hole; ±.003 on center distance between small cored holes; ±.002 on distance between end shoulder and small ear; ±.002 on center line of left, small cored hole to second step.



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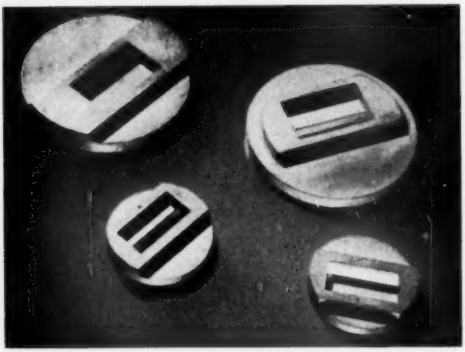


STAMPINGS OR FORGINGS have always held a pre-eminent place as caps for fuses having replacable links. The only physical requirement for such a part is moderately good electrical conductivity. Dimensional tolerances are wide and strength is relatively unimportant.

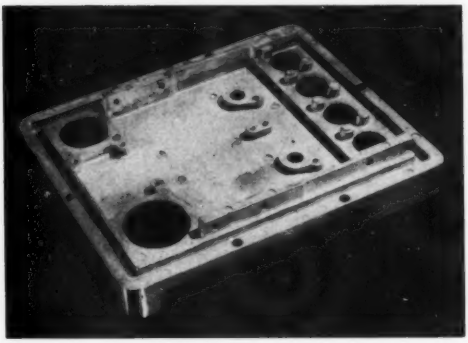
The part lends itself admirably, therefore, to fabrication as a low density, porous part from brass powder at extremely low cost. While full density and high physical strength caps could easily be made by the powder process and close dimensional tolerances held if it were necessary, the cost would be materially increased.

The fuse caps above are fabricated by the Presmet Corp., of Worcester, Mass. on high speed fully automatic presses at a fraction the cost of the older type they replace.

COMBINING PRESSURE TIGHTNESS WITH CLOSE DIMENSIONAL TOLERANCES is enough to give any die caster a prime headache. When an over-all length of over 8½ inches must be held to a total tolerance of ±0.005, one is reaching very nearly the limit of the ability of the die casting process.

The casting below is made in aluminum by the Tool & Die Engineering Co. of Cleveland, Ohio. Overall dimensions are 6⅛x8⅝ inches held as noted. To further complicate an already difficult casting the section thickness varies from 1½ to 3/32 inches and some center to center distances on holes have tolerances of as little as ±0.002.

The casting must be completely pressure tight without any filler or sealing material when tested hydrostatically at several hundred pounds pressure.



SMOOTH INSIDE SURFACES to 5 rms finish can be obtained by electroforming. The series of tapered forms shown at the left are good examples of this technique, with close dimensions on the internal surfaces. Notice also the stepped form at the narrow end. These pieces are produced by Bart Laboratories of Belleville, N. J.

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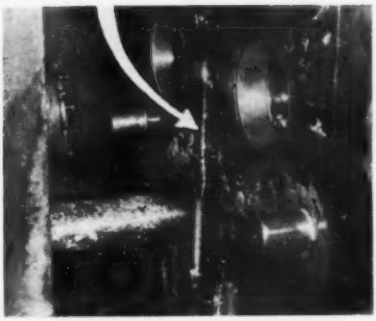

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CARBIDE DIES
continued from page 31

The grade of carbide is extremely important. Many carbide dies have been built which actually wore out faster than tool steel. It must be remembered that most metal powders used by the parts fabricator have a percentage of subsieve particles. These extremely small particles tend to imbed themselves in the relatively soft cementing matrix between the tungsten carbide grains of the

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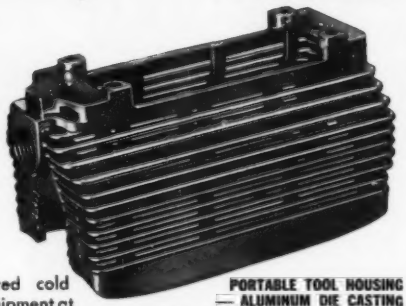

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tough grades of carbide which usually have a higher percentage of binder to carbide ratio than the hard grades.

This imbedding action causes tearing and high wear rates during compression and ejection cycles. High ejection pressures and hot parts point to the possibility that the wrong grade of carbide is being used.

The tool finisher is often plagued by porous carbide. A tool may be in the final polishing stage before a porous area is exposed. Scrapping the entire tool or segment is generally the only solution, as compacting tools with porous areas within the compression and ejection zone simply will not function properly. Erosion is rapid and parts are rough, cracked, or broken on ejection.

All vertical sections of dies, core rods, and punch facings, should be lapped and polished in the direction of compression and ejection of the briquetted part. Vertical die areas should bestraight with no concave or convex areas within the com-

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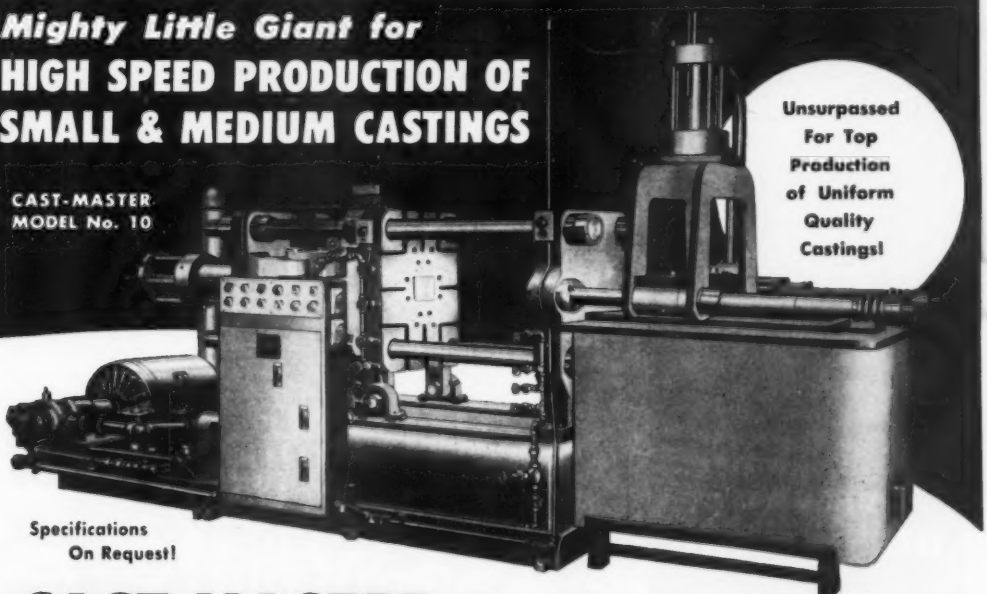

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pression and ejection sections. Slight upper punch entrance taper is often helpful, but taper should not exceed .0005 on a side unless it has been determined experimentally that more taper is required for the part being made. Upper punch entrance edges of the die should be broken by a radius of from .010 to .050 depending on the shape of the part and condition of the press. Usually .25 is suitable.

Punch facings and core rods are best made from the tougher but less wear resistant grades of carbide. They should be held mechanically whenever possible as brazed sections often come loose due to fatigue failure of the braze under repeated compression and tension loadings.

The use of carbide faced punches against carbide core rods and dies is practical providing proper clearance is maintained and good alignment is possible. When equipment is worn it

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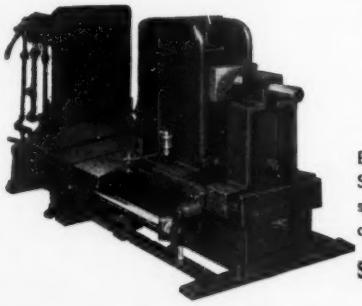

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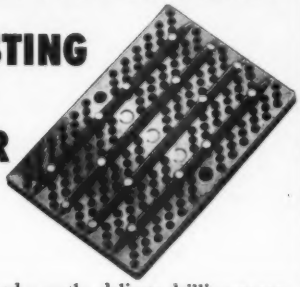
is more advantageous to use steel punches as it is almost impossible to maintain perfect alignment in a worn machine.

Attention should be given to proper lubrication of the powder mixture. Most of the so called metal soaps such as zinc, calcium, copper, barium, and lithium stearate provide satisfactory lubrication. The quantities vary from ½ percent to 1½ percent depending on the metal powder mixture and the required sintered density. When these lubricants are used in sintering furnaces having exposed heating elements, the furnace manufacturer should be consulted as under certain conditions degeneration of the elements may result from the use of one or more of the above lubricants. When muffle type furnaces are used no concern on this point is necessary. Lithium stearate is the best of the above lubricants and is often used in combination with zinc or calcium stearate in a ratio of 1 to 1.

When coining to high densities is required it is important to lubricate the parts externally after sintering. A satisfactory method is to spray a saturate solution of zinc or lithium stearate in acetone or carbon tetrachloride. Proper ventilation must be provided with either. The parts are allowed to dry before sizing or coining, and excess lubricant can be washed off easily with the same solvent used for the spray.

IMAGINATION

DIE CASTING by YODER



Imagination saved a costly, delicate drilling operation on this adding machine part. Cast with many indentations, this precision die casting requires only a simple milling job on the reverse side to finish its 182 small holes. Perhaps you have an application where die casting can save your production operations! Call, wire, or write today!

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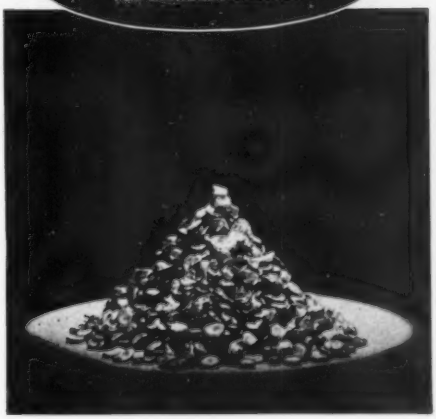

- no magnesium addition
- uniform pellets
- low melting point
- no dross

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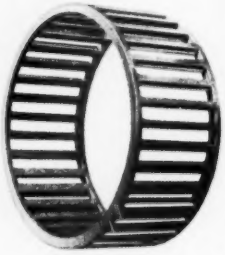

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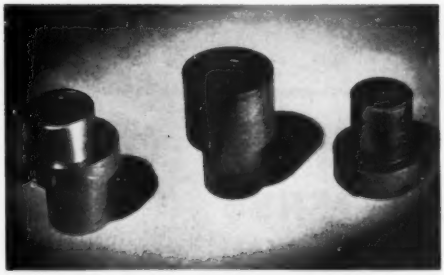
MOLDED PRECISION PARTS
continued from page 35

in which it operates. In the assembly, it is pressed into the channel and then run in so that the two parts are perfectly matched on each machine.

8. CAMMING SURFACES, FOR LONG LIFE AND ACCURATE CAM THROW should be continually lubricated. Without adequate lubrication, the wear, even on hardened surfaces, is sufficient to cause major inaccuracies in the throw. When a cast iron cam is used in a sewing machine, it is seldom oiled so that over a period of years, the action becomes improper.

Further, cams are generally held to closer than average tolerances, both as to size and throw.

All of these factors are true of the cams illustrated. Formerly made of cast iron, they are now fabricated from iron powder by the Wel-Met Company of Kent, Ohio, and have the dual advantage of both lower cost and longer life



8. EVEN WITHOUT OILING during their service life, these oil-impregnated metal powder cams have fine durability. Powder metallurgy overcomes a common problem caused by the housewife's neglect of oiling her machine.

due to their self-lubricating properties. To secure a surface that is slightly harder than a pure iron one, and without having to case carburize, from 7 to 10 percent of copper is added.

Both the self-lubricating properties and the machinability are improved by the addition of up to 2 percent of graphite.

The cam shown (above) illustrates how powder metallurgy can be used as a method of partially forming a part and later finishing it by standard machining methods. Obviously, the final shape cannot be formed by powder metallurgical processes. Resort to a considerable amount of final machining is, therefore, made. Even with this final work, the cost of the cam is lower than for a cast iron one.

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AGREE ON STANDARD STEEL TEST METHODS

Meeting at Columbia University, the International Organization for Standardization has reached an agreement on six methods of testing steel and steel castings. Thirteen nations are included in the group among whom agreement has been reached.

The testing methods covered are: Rockwell, Brinell, and Vickers (Diamond Pyramid) tests for hardness; the Bend test; and the Izod and Charpy impact tests.

Tolerances on the various dimensions, calibration of testing machines and accuracy are yet to be decided.

Three working groups, within the major committee, are now formulating proposals for tensile testing, tests of sheet and strip, and tests on wire. The recommendations of these groups will be presented at the next full scale meeting of the committee some time within the next two years.

NEW MAGNET MATERIAL

The Naval Ordnance Laboratory, White Oak, Md. has developed a new permanent magnet material said to exhibit a coercive force of 3000 oersteds. This is a higher coercive force than any other known permanent magnetic material The new alloy is composed of bismuth and manganese and is fabricated by powder metallurgcal techniques. A sintering temperature of 700 C is used, followed by hot pressing at 300 C. The flux density of the bismuth manganese alloy is second only to the platinum-cobalt alloys.

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Ferrous Metals Necessary?

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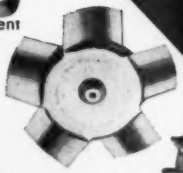

Automotive Parts

Aircraft Parts

Even though you have relied for years on ferrous metals as the basic materials for the manufacture of parts or products via sand casting, forming, stamping, etc., you can, in many cases, die cast these products with the wonderful new lightweight alloys—Magnesium and Aluminum. Indeed, many manufacturers have improved their products through the use of these new metal alloys. They have great tensile strength and offer major reductions where weight is important. Through die casting, much costly labor formerly required for machining and finishing is eliminated. *Illustrated are a few of the products manufactured by Litemetal Dicast, Inc. for varied concerns in the metal consuming industry.*

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